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# CONTENTS.

## PART I. MAY, 1855.

ART. I.—Notice of Producti found in the Western States and Territories, with descriptions of twelve New Species. By J. C. Norwood and Henry Pratten, of the Illinois Geological Survey, <sup>1</sup>	5
ART. II.—Notice of the genus Chonetes, as found in the Western States and Territories, with descriptions of eleven New Species. By Joseph G. Norwood and Henry Pratten, of the Illinois Geological Survey, <sup>2</sup>	23
ART. III.—Contributions to South American Herpetology. By Edward Hallowell, M. D.,	33
ART. IV.—Plantæ Heermannianæ. Descriptions of New Plants, collected in South California by Dr. A. L. Heermann, Naturalist attached to the Survey of the Pacific Railroad route, under Lieut. R. S. Williamson, U. S. A. With remarks on other Plants heretofore described and belonging to the same collection. By E. Durand and Theod. C. Hilgard, M. D.,	37
ART. V.—An account of several species of Fish observed in Florida, Georgia, &c. By John Edward Holbrook, M. D., Professor of Anatomy, &c., Charleston, S. C.,	47
ART. VI.—Researches on the Cryptogamic Flora of the State of Georgia. By Prof. Julien Deby,	59
ART. VII.—Descriptions of New Species of Birds of the Genus <i>Spermestes</i> , Swainson, in the Museum of the Academy of Natural Sciences of Philadelphia. By John Cassin,	69

## PART II. DECEMBER, 1855.

ART. VIII.—Notice of Fossils from the Carboniferous Series of the Western States, belonging to the genera <i>Spirifer</i> , <i>Bellerophon</i> , <i>Pleurotomaria</i> , <i>Macrocheilus</i> , <i>Natica</i> , and <i>Loxonema</i> , with descriptions of eight new characteristic species. By Joseph G. Norwood and Henry Pratten, of the Illinois Geological Survey, <sup>4</sup>	71
ART. IX.—Plantæ Prattenianæ Californicæ: An enumeration of a collection of California Plants, made in the vicinity of Nevada, by Henry Pratten, Esq., of New Harmony; with critical notices and descriptions of such of them as are new, or yet unpublished in America. By Elias Durand, <sup>5</sup>	79
ART. X.—Relation of Atomic Heat to Crystalline Form. By J. Aitken Meigs, M. D., <sup>6</sup>	105
ART. XI.—Contributions towards a knowledge of the Marine Invertebrate Fauna, of the Coasts of Rhode Island and New Jersey. By Joseph Leidy, M. D., <sup>7</sup>	135
ART. XII.—Descriptions of New Species of <i>Psittacidæ</i> , in the collection of the Academy of Natural Sciences of Philadelphia. By John Cassin, <sup>8</sup>	153

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## CONTENTS.

### PART III. NOVEMBER, 1856.

ART. XIII.—Descriptions of some remains of fishes from the Carboniferous and Devonian Formations of the United States. By Joseph Leidy, M. D., <sup>1</sup>	159
ART. XIV.—Description of some remains of extinct Mammalia. By Joseph Leidy, M. D., <sup>2</sup>	166
ART. XV.—On the Sandstone Fossils of Connecticut River. By James Deane, M. D., <sup>3</sup>	173
ART. XVI.—Plantæ Kaneanæ Grœnlandicæ. Enumeration of Plants collected by Dr. E. K. Kane, U. S. N., in his first and second expeditions to the Polar regions, with descriptions and remarks. By Elias Durand, <sup>4</sup>	179
ART. XVII.—A Commentary on the Synopsis Fungorum in Americâ Boreali mediâ degentium, by L. D. de Schweinitz. By the Rev. M. J. Berkeley, M. A., F. L. S., and the Rev. M. A. Curtis, F. A. A. S., <sup>5</sup>	205
ART. XVIII.—Synopsis of the Melolonthidæ of the United States. By John L. Le Conte, <sup>6</sup>	225

### PART IV. FEBRUARY, 1858.

ART. XIX.—Descriptions of Exotic Genera and species of the family Unionidæ. By Isaac Lea, LL. D., <sup>7</sup>	289
ART. XX.—Observations on a group of Cretaceous Fossil Shells, found in Tippah County, Miss., with descriptions of fifty-six new species. By T. A. Conrad, <sup>8</sup>	323
ART. XXI.—On the Caducibranchiate Urodele Batrachians. By Edward Hallowell, M. D., <sup>9</sup>	337
ART. XXII.—On Trigonophrys rugiceps. By Edward Hallowell, M. D., <sup>10</sup>	367

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ART. I.—*Notice of Producti found in the Western States and Territories, with descriptions of twelve New Species.* By J. C. NORWOOD and HENRY PRATTEN, of the Illinois Geological Survey.

The genus *Productus*, established by Mr. Sowerby, in 1814, being found so abundantly in the “mountain limestone,” of Europe, it was natural to suppose, that when this formation, which is so extensively developed in our Western and Southern States, came to be explored, it would yield many more species than it was known to furnish when M. de Koninck published his admirable monograph on the *Producti*, in 1847. This expectation has, in some degree, been realized; twelve new species being now added to the published catalogues of American and European palæontologists.

The wide distribution of this formation in North America, occupying, as it does, extensive districts in the States of Kentucky, Indiana, Illinois, Missouri, Iowa, Tennessee, Alabama, and Arkansas, together with Nebraska territory, as well as on the Humboldt river, in Utah, we may reasonably expect that the present list will be greatly extended, especially when the State collections of Missouri, Illinois and Kentucky come to be examined and collated.

It is not, however, in the “mountain limestone” alone that the *Producti* are so widely distributed. The marine limestones and calcareous clays of the coal measures are equally, if not still more, prolific in species of this genus. Many of the species in the following list are found, exclusively, in that formation; and, with a few species of other genera, are the most reliable indicators in the exploration of our Western coal fields.

In the Devonian limestones we have met with only two species, both of which are also found in Europe. One of them, the *P. Murchisonianus*, it is certain, also belongs to the upper Silurian rocks of Indiana. Several of the species described were found by Mr. Pratten in the Western part of Missouri, and on the Nemahaw river, in Nebraska, in a limestone, the age of which has not been yet determined.

In the "Report on the Geology of Wisconsin, Iowa, and Minnesota," Dr. D. D. Owen mentions having found the *P. marginalis*. As we have not met with that species, it is not included in the present catalogue. He also indicates several new species from North-western localities, of which it is to be hoped he will before long publish descriptions.

At the time M. de Koninck's work was published, the whole number of species known was sixty-two. Dr. D. D. Owen added one from the U. S. Survey. We have now added twelve, which makes the number of the species known, in all countries, up to the present time, seventy-five. It may also be seen, by consulting M. de Koninck's work, that, at the time of publication (1847), the whole number of species known to occur in the United States and Territories amounted only to seven. They now number thirty, and the probability is, that future investigations will greatly extend the catalogue.

For the beautiful and accurate drawings of the species now published, we are entirely indebted to Mr. H. A. Ulffers, of the Illinois State Survey.

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## MOLLUSCA BRACHIOPODA.

Genus *PRODUCTUS*, *Sowerby*.

### Section I.

#### PRODUCTI STRIATI.

*P. MARGARITACEUS*, *Phillips*.—De Koninck,—“Monograph on the Genus *Productus*.” Pl. IV., fig. 3.

*Locality*.—Twelve miles N. W. of Richmond, Missouri, in calcareous clay, overlying thick beds of limestone.

*P. FLEXISTRIA*, *McCoy*.—De Koninck's monograph. Pl. XVII., fig. 1.

*Localities and Geological Position*.—Found in the mountain limestone of Chester, Kaskaskia and Mountain Bluff, Illinois, and near Stephensport, Kentucky.

*P. CORA*, A. d'Orbigny.—De Koninck, “On the Fossils of Belgium.” Pl. IV., fig. 4, and Pl. V., fig. 2.

*Localities and Geological Position*.—In the mountain limestone of Chester, Rosiclare, Warsaw, and other places in Illinois; near Richmond, Missouri; and at Carrsville,

Kentucky. This beautiful *Productus* is very widely distributed in the Western States.

*P. ALTONENSIS*, *nob.*—Pl. I., fig. 1, *a*, *b*, *c*.

Shell of a medium size, dorsal valve regularly vaulted and strongly curved on itself, very much inflated, geniculated, anterior part flattened. Beak swollen, and passing beyond the cardinal border. Surface covered with a great number of slender, filiform ribs, which frequently bifurcate, while occasional new ones are implanted between the old ones. This shell appears to have been rather irregular in its growth, for, while some specimens are slightly transverse, others are a little longer than broad. The sides are flattened, so as to fall almost perpendicularly on the ears, which are small, and crossed by several undulating folds, as in the *P. cora*; they are, however, sharper and more numerous than in that species. Two or three ranges of small tubercles are placed on these folds. Some of the specimens show that there have been ranges of tubes across the anterior portion of the shell, somewhat similar to those on occasional specimens of the *P. Flemingii*. In addition to these, a few tubes are scattered over the remainder of the surface.

The ventral valve is very regularly concave on the visceral portion, but becomes more abruptly bent as it approaches the other valve, so as to follow it in its anterior prolongment, which is, however, short. Its ribs are like those of the dorsal valve; the ears have a few folds, with slender tubercles, like those of the dorsal valve. The visceral part is also crossed by several folds, which become very indistinct as they approach the centre of the shell.

*Dimensions*.—Length, 25 millimetres; thickness, 9 millimetres. At the distance of 20 millimetres from the beak, the ribs number 18 in the space of 10 millimetres.

*Comparisons and Differences*.—This shell approaches more nearly to the *P. cora*, in its general appearance, than any other species of the genus we have met with. It may, however, be easily distinguished from that species by the greater regularity of its ribs, which are not bent and contorted, as they are in the *P. cora*; by the size of the ribs, which are larger in the *P. Altonensis*; and by the greater number of small tubercles with which its surface, especially the anterior part, is furnished. It is still more distinctly marked by the lines of increment which cross the ribs on their anterior prolongment, and give to that portion of the shell a reticulated appearance, particularly when seen through a lens. This characteristic is never met with in the *P. cora*. From the *P. Flemingii* it may be easily distinguished by the absence of a sinus, and by the non-reticulation of the visceral portion. It cannot be confounded with any other known species than those above mentioned.

*Locality and Geological Position*.—Alton, Illinois, in the upper portion of the mountain limestone series.



*Explanation of the figures.*—Pl. I., fig. 1, a. Specimen showing the dorsal aspect of an adult individual. Illinois State Collection.

Fig. 1, b. Another specimen, showing the ventral valve, without the anterior prolongment.

Fig. 1, c. The same seen in profile.

P. PHILLIPSII, nob. Pl. I., fig. 2, a, b, c.

Shell rather small, nearly as long as broad, dorsal valve slightly gibbous, its anterior part flattened, with a wide shallow sinus on old specimens, while young ones do not show it. The beak, although slightly enrolled on itself, does not pass the cardinal border. The ears are small, flattened and smooth, showing no trace of either folds or tubes. The surface is covered with coarse, irregularly sized ribs, which are generally broader than the furrows separating them. Many of the ribs are bifurcated. The cardinal line measures four-fifths of the greatest breadth of the shell. The sides fall perpendicularly on the ears. The only traces of tubes are a few indistinct ones on the flanks.

Ventral valve concave, with a very slight varix. The visceral disk has ribs similar to those on the other valve; beyond the disk they are obliterated, the surface being covered with nine or ten broad lamellæ, the edges of which are turned sharply upward, presenting acute wavy ridges, which are continued on to the cardinal border on each side.

*Dimensions.*—Length, 19 millimetres. *Proportions.*—Length 100, breadth 100, thickness .047.

*Ribs.*—Near the anterior border there are from eight to ten in the space of ten millimetres, and number, altogether, about twenty-eight.

*Comparisons and Differences.*—By the coarse irregular ribs of the dorsal valve, by the visceral portion of the ventral valve possessing ribs, together with the broad, ridged lamellæ around it, this species may be easily distinguished from any other. It does not appear to have possessed an anterior prolongment, as its present front is without one, and is bounded by a sharp margin.

*Geological Position and Locality.*—Mr. Pratten found this in Utah Territory, at the "Big Cañon" of Humboldt river. It occurs in the mountain limestone, associated with *P. semireticulatus* of Martin, and the *Spirifer tricornis* of de Koninck.

*Explanations of the Figures.*—Pl. I., fig. 2, a. View of the dorsal valve. Mr. Pratten's collection.

Fig. 2, b. Same, showing the ventral valve.

Fig. 2, c. Profile view of the same specimen.

Dedicated to Prof. John Phillips, whose admirable works on geology and paleontology have contributed so much toward the advancement of those sciences, in both hemispheres.

## Section II.

## PRODUCTI UNDATI.

*P. UNDIFERUS*, de Koninck.—“Fossils of Belgium.” Pl. V., fig. 4, and Pl. XI., fig. 5.

*Geological Position and Localities.*—In Belgium this shell belongs to the mountain limestone series, while in this country we have found it only in the coal measures, and as yet at only three localities, Caseyville, Illinois, and two places in Posey county, Indiana. At Caseyville it occurs in a thick bed of limestone, overlying the five foot seam of coal. Illinois State Collection.

*P. ROGERSII*.—*nob.* Pl. I., fig. 3, *a*, *b*, *c*.

Shell of medium size; slightly transverse; dorsal valve very high and strongly enrolled on itself; cardinal border equal to about four fifths of its greatest transverse diameter; beak rather large, and passing beyond the cardinal border; ears but little distinct from the dorsal vault. The anterior part is flattened, and possesses a slight sinus. The surface is covered with ribs, of which twelve may be counted in the space of ten millimetres, at the distance of ten millimetres from the beak. It is also covered in its whole extent with transverse folds. Those nearest the beak are rather small, but, after passing the visceral disk they rapidly increase in size to near the middle of the shell, after which they again decrease in size to the margin. The whole anterior portion of the shell seems to have been pretty thickly covered with tubercles, especially between the transverse bands, while a few were distributed over the remainder of the surface. On the middle part of the shell there are only — transverse bands in the space of ten millimetres.

*Dimensions.*—Length, 21 millimetres; breadth, 24 millimetres.

*Comparisons and Differences.*—Although we have only one specimen of this species, and from this one the shell is abraded over the greater portion of its surface, still its form and characteristics are so distinct that it cannot be confounded with any other. The *P. undatus* comes nearest to it, but our species differs from the *undatus* in having larger ribs, and flattened transverse bands, while the bands of the *undatus* are sharp. The *P. Rogersii* is further distinguished by having its anterior prolongment covered with tubercles, some of which, judging from a few remaining fragments, must have been of considerable length. Ventral valve unknown.

*Geological Position and Locality.*—This specimen was found by Mr. Pratten in the coal measures, near Huntsville, Missouri. It occurs in a bed of ferruginous limestone overlying a stratum of bituminous shale.

*Explanation of the Figures.*—Pl. I., fig. 3, *a*. View of the dorsal valve. H. Pratten's collection.

*Fig. 3, b.* View of the beak, showing at the same time the depth of the sinus.

*Fig. 3, c.* The same specimen shown in profile.



This species is dedicated to our friend, Prof. Henry D. Rogers, as a slight testimony of our high appreciation of his labors in American geology.

*Section III.*

PRODUCTI PROBOSCIDEI.

PRODUCTUS CLAVUS, *nov.*—Pl. I., fig. 4, *a*, *b*, *c*.

This very singular shell is the only one of the class we have met with, and it is in so imperfect a state of preservation that for some time we hesitated about including it in the present notice. Like its European congeners, however, it is so rare, and so remarkable in form, that we have concluded to figure it, and give such a description as the mutilated specimen before us will admit of, in the hope of being able to furnish a more complete one when we shall be so fortunate as to secure more perfect specimens.

This species is small, longer than broad, the dorsal valve is divided into two very distinctly marked parts, distinguished especially by the direction of the bands and ribs. The visceral portion is slightly arched, and covered with well defined transverse bands, separated by somewhat deep furrows, the furrows being ornamented by delicate striæ, having the same direction as the bands. The bands are about twenty in number, and appear to reach, all of them, up to the cardinal border on both sides. They are narrower towards the beak, and increase in width, although not regularly, as they approach the front, some of them being more prominent than others. The beak is small; pointed; shows no evidence of a median sinus; and appears to pass little, if any, beyond the cardinal border.

The prolongment is cylindrical, and slightly contracted at its junction with the visceral portion; straight, and in the direction of the axis of the shell. It is covered with broad, regular ribs, numbering about twenty in the space of ten millimetres. The ribs of the prolongment can be traced on to the last fold of the visceral part, giving it a reticulated appearance. Whether the prolongment was closed all round, as in the *P. proboscideus*, or open on the ventral side, as in the *P. genuinus*, cannot be decided from the imperfect specimen before us.

*Dimensions.*—Length of the visceral part, 11 millimetres; breadth the same. Diameter of the prolongment, 7 millimetres; length of the part preserved equal to that of the visceral portion.

*Comparisons and Differences.*—It differs from the *P. proboscideus* of Mr. de Verneuil with which alone it can be confounded, in the longitudinal ribs not extending over the visceral portion, and in the prolongment not showing the numerous and well-marked transverse folds of that species. The longitudinal ribs of the *proboscideus* are also much finer, numbering about fifty in the space of ten millimetres at the anterior border of the visceral part. Our species shows no trace of a sinus.

*Geological Position and Locality.*—This specimen was found by Mr. H. A. Ulffers, among the debris from rocks collected at Grayville, Illinois, where it occurs in the upper part of the coal measures.

*Explanation of the Figures.*—*Pl. I., fig. 4, a.* View of the dorsal valve, with so much of the prolongment as is preserved.

*Fig. 4, b.* The beak.

*Fig. 4, c.* View of the transverse bands of the visceral part, magnified four times. Collection of H. A. Ulffers.

#### Section IV.

#### PRODUCTI SEMIRETICULATI.

*P. BOLIVIENSIS, A. d' Orbigny.* De Koninck "On the Genus Productus," Pl. VIII., fig. 2.

*Geological Position and Locality.*—Found twelve miles North-West of Richmond, Missouri, in limestone, where it is associated with fossils belonging to the coal measures. H. Pratten's collection.

*P. SEMIRETICULATUS, Martin sp.*—De Koninck's Monograph, Pl. VIII., fig. 1, pl. IX., fig. 1, and pl. X., fig. 1.

*Geological Position and Locality.*—This species is very generally distributed in the mountain limestone of the Western States. Illinois State Collection.

*P. CARBONARIUS, de Kon.*—De Koninck "On the Genus Productus." Pl. V., fig. 4.

*Geological Position and Locality.*—This species is very common at Fountain Bluff, Illinois, in the mountain limestone. Illinois State Collection.

*P. COSTATUS, Sowerby.*—De Koninck's Monograph. Pl. VIII., fig. 3, pl. X., fig. 3, and pl. XVIII., fig. 3.

*Geological Position and Locality.*—This fossil, although belonging to the mountain limestone of Europe, is, in the Western States, a characteristic fossil of the coal measures. It occurs in limestone at Caseyville and Belleville, Illinois, and at Carboniere, St. Louis county, Missouri.

*P. FLEMINGII, de Kon.*—De Koninck "On the Genus Productus." Pl. X., figs. 2 and 3.

*Geological Position and Locality.*—This fossil occurs in the mountain limestone of Hardin county, Illinois; Leavenworth, Indiana, and Burlington, Iowa.

*P. SPLENDENS, nob.*—Pl. I, fig. 5, *a, b, c, d.*

Shell small, transverse, the cardinal edge being the widest part; somewhat inflated; but with its visceral and anterior parts rather flattened. Ears very much extended, each bearing, generally, two thick tubes, and are a little enrolled. The surface is

furnished with about thirty tolerably thick ribs. It is difficult to count them, however, in consequence of the shell, which is very thick, being formed of several layers, which exfoliate easily. The beak is small, hardly passing the cardinal border. The visceral part is reticulated by wide, shallow, concentric folds. The dorsal valve is divided by a deep sinus. There are, generally, from six to eight thick tubes scattered over the surface, three or four of which range across the shell in a tolerably straight line, about half way between the visceral portion and the front line of the ventral valve.

Ventral valve concave; ribs like those of the other valve, broad and but little raised, while the shallowness of the furrows which separate them renders it as difficult to number them as those of the opposite valve. The visceral part is crossed by irregular concentric lines. Although the ventral valve is concave over most of its extent, yet, a little before it reaches the opposite one, it suddenly flattens, presenting the appearance of a flat band, which passes around its anterior and lateral borders. This band is a little over one millimetre in width, and is divided from the concavity of the shell by a slightly raised ridge on its interior border. On the visceral portion of the interior of the dorsal valve there is a strong middle projection, on each side of which are the hepatic apophyses, deeply hollowed out in the substance of the shell; they are triangular, with their anterior part very much ramified. The remainder of the fossil is covered with granular points, which leave corresponding hollows on the internal mould when the shell is taken off.

*Dimensions.*—Length, 18 millimetres; width, measured along the cardinal border, 26 millimetres. The angle formed between the lateral and cardinal borders is  $62^{\circ}$ . The whole number of ribs is thirty-two.

*Comparisons and Differences.*—This species approaches, in many respects, to the *P. expansus* of De Koninck. It may be easily distinguished from that species, however, by the following characters: the ears of the *splendens* are rounded, while, according to de Koninck, those of the *expansus* are flattened,—it has several thick tubes on the anterior prolongment, the *expansus* has none,—it has a very thick shell, while that of the *expansus* is thin. When a detached ventral valve can be obtained, the flat border around it will at once distinguish the *splendens*.

*Geological Position and Localities.*—This beautiful species occurs at Galatia, Illinois, in the coal measures; six miles West of Richmond, Missouri, and near Big Creek, Posey county, Indiana, in a black limestone belonging to the coal measures.

*Explanation of the Figures.* Pl. I. fig. 5, a.—View of the dorsal valve of an adult individual.

Fig. 5, b.—View of the ventral valve of another specimen, showing the flat band around the margin.

Fig. 5, c.—Profile view of a.

Fig. 5, d.—Same, showing a longitudinal section. Illinois State Collection.



*P. WABASHENSIS*, *nob.*—Pl. I., fig. 6, *a, b, c, d.*

Shell small, transverse; dorsal valve gibbous, enrolled on itself; beak small, pointed, and not passing the cardinal border. This valve is divided in its middle by a wide, deep sinus. The surface is covered by about forty ribs, some of which, however, after leaving the visceral part, unite, so as to form by their junction one thicker rib; but this character is not constant, as some specimens possess it while others do not. The ears are thin and enrolled; no tubes have yet been discovered on them. The cardinal border is of about the same breadth as the greatest transverse diameter of the shell. On the surface of the shell itself there are, generally, from six to eight tubes, very thick and long for the size of the shell, one, still attached, being over seven millimetres long. The transverse folds on the visceral disk are wide and shallow, so as to be hardly apparent.

The ventral valve is very concave, following nearly the movement of the opposite valve; ribs like those of the dorsal, but it has neither tubes nor hollows. It is furnished with a very decided varix, corresponding to the sinus of the dorsal valve.

*Dimensions.*—Length, 13 millimetres; breadth, 16 mm.; thickness, 6 mm.

*Ribs.*—Forty on the entire surface.

*Comparisons and Differences.*—When this shell is entirely disengaged from the rock, it cannot be mistaken for any other species; but when the dorsal valve only is exposed, it may be confounded with the *P. splendens*; but even then it may be easily recognized by its much shorter cardinal border. If the specimen has lost its shell, the ribs are still shown on the mould in this species, with a series of rounded hollows along each furrow, between the ribs, while in the *splendens* the hollows are irregularly distributed over the entire surface of the mould, without any appearance of ribs being shown. The nacre of the shell is still very brilliant.

*Geological Position and Locality.*—As yet this species has only been found near New Harmony, Indiana, in the middle part of the Coal Measures.

*Explanation of the figures.*—Pl. I., fig. 6, *a.* Dorsal aspect of the shell.

*Fig. 6, b.* Ventral view of the same, showing the hinge-line and the beak.

*Fig. 6, c.* The same, as seen in profile.

*Fig. 6, d.* Another specimen, showing one of the long spines. H. Pratten's collection.

*P. ELEGANS*, *nob.* Pl. I., fig. 7, *a, b, c.*

Shell small; gibbous; longer than broad; dorsal valve curved, and without a sinus; beak inflated, and passing beyond the cardinal border. Cardinal line shorter than the greatest breadth of the shell. Ears small, and covered with a great number of small, slender tubercles. The surface of the shell is covered with rather large rounded ribs, which regularly increase in size from the beak to the front in most specimens, while

on others they are found bifurcating, or with new ribs implanted between the old ones. On the flanks of the shell the ribs are nearly obliterated, but a great number of small spines are seen. A few small spines are, also, scattered over the remainder of the surface. The visceral part is crossed by irregular folds, not so decided as the ribs, but sufficiently well marked to give it a reticulated appearance. The remainder of the surface is covered with fine undulating lines of growth. When the shell is removed, a broad irregular furrow is seen passing round from the front to the ears on each side, and separating the upper portion of the dorsal valve from its anterior prolongment.

Ventral valve very concave; ribs like those on the dorsal valve, and crossed on the visceral part by shallow concentric folds, a little better marked than those on the opposite valve. The visceral portion is distinctly limited by a large imbricated fold. The ears and flanks are covered with tubercles, similar to those of the other valve.

*Dimensions*.—Length, 20 millimetres. *Proportions*.—Length, 1.00; breadth, 0.75; thickness, 0.30.

*Ribs*.—On the margin of the transverse furrow, twelve may be counted in the space of ten millimetres.

*Comparisons and Differences*.—This species resembles somewhat the *P. flexistria*, but may be distinguished from it by the visceral disk being reticulated, and by the great number of small tubercles with which the surface, especially the flanks, are garnished.

*Geological Position and Localities*.—This species occurs abundantly in the Mountain limestone at Chester, and at Kaskaskia, Illinois, and in Missouri, near Hat Island.

*Explanation of the Figures*.—Pl. I., fig. 7, *a*. View of the dorsal valve.

Fig. 7, *b*. View of the ventral valve.

Fig. 7, *c*. Profile view of the same. Illinois State Collection.

*P. MURICATUS*, (not of *de Koninck* or *Phillips*), *nob.* Pl. I., fig. 8, *a*, *b*, *c*, *d*, *e*.

Shell small; transverse; dorsal valve tolerably regularly vaulted; surface covered with ribs which are rather thick in comparison with the size of the shell. Cardinal border nearly as long as the greatest width of the shell. Ears thin and flattened, with six tubes on each. Beak small; not passing the cardinal border. The whole surface is irregularly covered with spines, which project at right angles from the surface of the shell. Visceral disk somewhat flattened and reticulated, the transverse folds being more decided than the ribs themselves, which gives to that portion of the fossil a rugose appearance.

Ventral valve concave; its ribs are mostly obliterated by the concentric folds on the visceral portion, beyond which, however, they appear like those on the dorsal valve. On the interior it has a bifid tooth, supported by a median ridge, which

extends inwards to the centre of the valve. On each side of this are the hepatic apophyses, small and triangular; by the sides of these are two depressions, and projecting forwards and laterally from these are two large callosities, bounded, anteriorly, by a prominent ridge. On the anterior portion of the visceral disk are several long, obtuse points, inclining forwards, posterior to which the surface is covered by other shorter ones. In front, and along the sides of the visceral disk, are a great number of points imbedded in the shell and looking forwards, but few of which rise above its surface. From near the extremity of the tooth, at a short distance from the cardinal border, proceeds, on each side, a strong and rather sharp ridge, running towards the lateral angles of the shell, but increasing its distance from it as it recedes from the tooth. Just before reaching the lateral edges it changes its direction, bends around with them, and becomes lost, being absorbed by the shell. This ridge, with the front of the shell, presents an oval outline.

*Dimensions*.—Length, 14 millimetres; breadth, 19 mil. *Proportions*.—Length, 100; breadth, 135; thickness, 0.42.

*Ribs*.—The whole number is from 22 to 24.

*Comparisons and Differences*.—By the small number of ribs, the rugose appearance of the visceral disk, and the great number of slender spines, with which its entire surface is garnished, this *Productus* may be easily distinguished from any other known species.

*Geological Position and Localities*.—This fossil belongs to the coal measures, and is found in the calcareous clays of that formation. It occurs at Fish-hook creek, Pike county, Illinois, and six miles north-west of Richmond, Missouri.

*Explanation of the Figures*.—Pl. I., fig. 8, *a*. View of the dorsal valve of an adult individual.

*Fig. 8, b*. Ventral aspect of the same.

*Fig. 8, c*. The same shown in profile.

*Fig. 8, d*. View of the interior of the ventral valve, showing the tooth, the median ridge, the hepatic apophyses, the callosities, and the lateral ridges.

*Fig. 8, e*. View of the interior of the dorsal valve. Illinois State Collection.

*P. PORTLOCKIANUS, nob.*—Pl. I., fig. 9, *a, b, c*.

Shell of a medium size; transverse; dorsal valve gibbous, much enrolled on itself, and divided by a wide deep sinus, originating at a short distance from the beak, and extending to the anterior border. Beak thick and short, not passing the cardinal border. Cardinal border longer than the transverse diameter of the shell. Ears rather long, rounded; follow, in a great degree, the vaulting of the dorsal valve; covered with thick transverse folds; two or three tubes on each. Visceral disk large; a little flattened; crossed by very decided transverse folds, twice as large as the ribs



which they decussate. Surface covered with large ribs, some of which bifurcate near the visceral part; on the anterior portion they unite, two, three, and sometimes four, uniting to form a broad flat surface; but after proceeding in this manner for a short distance, they again separate. On these flat surfaces the striæ of growth are well marked. A few thick tubercles are scattered over the surface. Ventral valve unknown.

*Dimensions*.—Length, 24 millimetres. *Proportions*.—Length, 1.00; breadth, 1.25.

*Ribs*.—On the anterior part, where the ribs are joined together, there are only five in the space of ten millimetres; after they divide again there are ten in the same space. On the visceral disk there are twelve in the same interval, crossed by six of the transverse folds.

*Comparisons and Differences*.—This species approaches very nearly to the *P. costatus*, but differs from it in several important particulars. The ears of the *costatus* are sharply detached from the sides of the shell, while in the *P. Portlockianus* the sides slope gradually down to the cardinal border, and follow in their contour the vault of the dorsal valve. The cardinal border is also longer in our species; and the angle formed by that portion of the shell and the lateral edges is only  $85^{\circ}$ , while in the *costatus* it is  $100^{\circ}$ . It also differs in its ribs, none of which project beyond the others, as they do in that species, but are all flattened alike on the anterior portion. The transverse folds on the visceral portion are also broader than they are in the *costatus*. Again, the sinus of the *Portlockianus* is much deeper and narrower than that of the *costatus*. There is only one other species with which it could be confounded, the *P. Boliviensis*; but it may be at once distinguished from that fossil by the shape of its ears, which are, in the *Boliviensis*, more abruptly separated from the sides than in any other known species of the genus; and by its beak passing far over the cardinal border, while in the *Portlockianus* it scarcely overlooks it.

*Geological Position and Localities*.—We have only met with two specimens of this species; one at Grayville, White county, Illinois, and the other at Charboniere, St. Louis county, Missouri. They both occur in the coal measures.

*Explanation of the Figures*.—Pl. I., fig. 9, *a*. View of the dorsal valve.

Fig. 9, *b*. View of the beak, with all the reticulated portion of the dorsal valve, with the exception of three transverse folds.

Fig. 9, *c*. Profile view of the same. Illinois State Collection.

We dedicate this species to Col. J. E. Portlock, of the Geological branch of the Ordnance Survey of Ireland, who has done so much to elucidate the geology and palæontology of that country.

*Section V.*

## PRODUCTI SPINOSI.

P. VILLIERSI, *A. d'Orbigny*.—De Koninck "On the Genus Productus." Pl. XI., fig. 1.

*Locality*.—Keg Creek, Missouri. Illinois State Collection.

P. SCABRICULUS, *Martin* sp.—De Koninck "On the Genus Productus." Plate XI., fig. 6.

*Geological Position and Locality*.—This fossil is found generally distributed in the limestones of the coal measures. It is also met with in the mountain limestone at Paris, Missouri. Illinois State Collection.

P. PRATTENIANUS, *nob.*—Pl. I., fig. 10, *a, b, c, d.*

Shell of medium size, transverse. When placed on its ventral valve, presents a rectangular form. Cardinal line equal to the greatest breadth of the shell. The ears are much extended, and garnished with a double row of tubes, very large in proportion to the size of the shell; those nearest the cardinal border being directed backwards, and projecting far beyond the edge, while those in the second rank point immediately upwards. The ears are covered with large folds. On the visceral portion a few irregular undulations occur, none of which traverse it entirely. Dorsal valve tolerably regularly arched; its anterior part flattened, sometimes depressed in the middle, and then showing a wide, shallow sinus. The sides slope very gradually down to the ears. The beak is small, rather pointed, and passes the cardinal border. The surface is covered with a great number of longitudinal ribs, regular in form, and increasing by the implantation of new ones. From twenty to thirty tubes are scattered over the surface; the remains of which show them to have been very long in proportion to the size of the shell. They all project from the shell at nearly right angles to their attachment, but, after proceeding a short distance, bend downwards. The anterior prolongment is broken off on every specimen in our possession, with the exception of a small fragment on the flank of one. This fragment passes about ten millimetres beyond the visceral disk of the ventral valve.

Ventral valve concave, the visceral disk being divided from the ears by a very large fold, with a deep hollow between this fold and the cardinal border. On this valve there are neither tubercles nor hollows; its ribs are like those of the dorsal valve. Outside of the visceral disk the shell is traversed by three or four wide imbricated folds. On the interior of the ventral valve there is a small bifid tooth, with a rounded hollow at its base, from which projects a very slender ridge, which crosses about one third of the valve.

*Dimensions*.—Length, 20 millimetres. *Comparison*.—Length, 100; breadth, 130; thickness, 0.35.

*Ribs*.—At the distance of ten millimetres from the beak there are eighteen in the space of ten millimetres.

*Relations and Differences*.—This shell may be readily distinguished from the *P. Villiersi*, to which it bears resemblance, by its visceral part being less enrolled; in having a more depressed form; in the great extent of its ears; in its beak being smaller and more pointed; and in its tubes projecting more directly out from the shell, instead of proceeding downwards in their attachment, as they do in the *P. Villiersi*.

*Geological Position and Locality*.—This species is supposed to belong to the coal measures; it is not, however, absolutely determined. It was obtained by Mr. H. Pratten at the crossing of the Big Nemahaw river, about 85 miles a little North of West from St. Joseph, Missouri.

*Explanation of the figures*.—Pl. I., fig. 10, *a*. View of the dorsal valve of an adult individual.

*Fig. 10, b*. Same, showing the ventral valve.

*Fig. 10, c*. The same, seen in profile.

*Fig. 10, d*. Another specimen, showing the comparative length of the tubes. H. Pratten's collection.

*Note*.—It affords me great pleasure to be able to dedicate this new and beautiful species to my friend and fellow laborer, Mr. H. Pratten; to whose quiet but fruitful labors, for many years, several branches of science, besides geology, are largely indebted.

J. G. N.

*P. HILDRETHIANUS, nob.*—Pl. I., fig. 11, *a, b, c*.

Shell of medium size; depressed; transverse; subtriangular. Surface covered with moderately-sized, rounded ribs, the furrows between which are wider than the ribs themselves. The ribs are increased both by bifurcation and the implantation of new ones. The front is flattened, with a very wide but shallow sinus. Beak small, pointed, passing beyond the cardinal border, which appears to have been short; in the only specimen found, however, the cardinal border is unfortunately broken off, on both sides, at about six millimetres from the beak, so that we have little of the ears remaining. The sides fall almost perpendicularly on to the ears. The ears and flanks are covered with a great number of small, slender tubercles. The whole surface of the shell appears to have been covered with tubercles, which have fallen off, in the specimen before us, leaving scarcely a mark of their place of attachment. We infer, from this, that they fell off during the life of the animal, as it is difficult to see the cicatrices without the aid of a good lens. There are no concentric folds; but the entire surface is covered with fine undulating striæ of growth. Anterior prolongment, if any, unknown.

On the ventral valve, the ribs appear to radiate from the beak. In the first part of their course they frequently bifurcate; afterwards few of them do so. They go on, however, regularly increasing in size, down to the margin; and are covered with a great number of elongated tubes, lying closely down on the shell. This valve is a little concave, with a slightly raised varix opposite the sinus of the dorsal valve.

*Dimensions.*—Length, 28 millimetres. *Comparison.*—Length, 100; breadth, 111; thickness, 0.40.

*Ribs.*—At twenty millimetres from the beak there are ten in the space of ten millimetres.

*Comparison and Differences.*—We know of no *Productus* that can be confounded with this species. Its flattened and triangular form, the greatest breadth being near the front margin, from which it regularly decreases to the beak, as well as the great number of spines on the ventral valve, will at once distinguish it from all others.

*Geological Position and Locality.*—It occurs in nodules of black limestone, imbedded in a coal seam, at Charboniere, Missouri.

*Explanation of the figures.*—Pl. I., fig. 11, *a.* Dorsal aspect.

Fig. 11, *b.* View of the ventral valve.

Fig. 11, *c.* Profile view of the same specimen. H. Pratten's collection.

This species we dedicate to Dr. S. P. Hildreth, of Marietta, Ohio, one of the oldest pioneers of geological science in the Western States.

#### Section VI.

#### PRODUCTI FIMBRIATI.

*P. LEUCHTENBERGENSIS*, *de Koninck*.—De Koninck "On the Genus *Productus*." Pl. XIV., fig. 3.

*Geological Position and Locality.*—In the mountain limestone at Mason's Landing Jersey county, Illinois. Illinois State Collection.

*P. PUNCTATUS*, *Martin* sp.—De Koninck "On the Genus *Productus*." Pl. XII., fig. 2.

*Geological Position and Locality.*—Warsaw, Illinois, in mountain limestone; twelve miles North West of Richmond, Missouri; near Caseyville, Illinois, in the coal measures. This is a very common fossil in the Western States. Illinois State Collection.

*P. FIMBRIATUS*, *Sowerby*.—De Koninck "On the Genus *Productus*." Pl. XII., fig. 3.

*Geological Position and Locality.*—Near Alton, Illinois, in the mountain limestone; and at Big Creek, Posey county, Indiana, in the coal measures. Illinois State Collection.



*P. BUCHIANUS*, *de Koninck*.—De Koninck "On the Genus Productus." Pl. XVIII., fig. 4.

*Geological Position and Locality*.—Found in the black limestone of the coal measures, at Big Creek, Posey county, Indiana. H. Pratten's collection.

*P. ALTERNATUS*, *nob.* Pl. II., fig. 1, *a, b, c, d, e.*

Shell of medium size; length and breadth about the same. In young specimens the dorsal valve is tolerably regularly arched, but is flattened on its anterior part, without showing, however, any anterior prolongment; when old, it has a decided anterior prolongment, proceeding at right angles from the visceral portion. The old specimens have, also, a wide but shallow sinus. The surface is covered with wide, flattened, transverse bands, placed one above the other, like tiles on a roof. These bands are covered with spines, of which every eighth one reaches from the lower edge of the band above to the lower edge of its own band. Midway between these are other spines, which only reach half way up the band; and, between these again, are others, which are only half the length of those last mentioned; and, finally, between the latter come out small tubes or points, which are planted immediately on the lower edge of the band. Some of these tubes are from five to eight millimetres in length, and project downwards close to the shell, forming a fringe around the lower edge of each band. Beak small and passing beyond the cardinal border. Ears small and a little enrolled.

Ventral valve almost unknown. We have only one specimen which shows any portion of it, and that exhibits only a fraction of the internal surface. It is nevertheless, sufficient to show that this valve possessed bands like those of the dorsal valve, that it followed all its movements, and that its visceral disk approached very near to that of the other valve, there not being a distance of four millimetres between them. Its internal surface is pitted with small hollows, corresponding to the tubes of the dorsal valve.

*Dimensions*.—Length, 28 millimetres. *Comparison*.—Length, 100; breadth, 100; thickness, 0.14.

*Bands*.—On an old specimen the whole number of bands are fifteen. At ten millimetres from the beak there are three bands in the space of ten millimetres.

*Comparisons and Differences*.—This shell differs from the *P. punctatus* in being smaller: in its broader and more regular bands; in the arrangement of the spines on the bands; in its flattened anterior prolongment; and, especially, by the close approximation of the two valves.

*Geological Position and Locality*.—Found in the mountain limestone, at Rocky run, Hancock county, Illinois. Rare.

*Explanation of the Figures*.—Pl. II., fig. 1, *a.* View of the dorsal valve, showing the transverse folds and striae.

- Fig. 1, b.* Profile view of an older specimen.  
*Fig. 1, c.* Same, showing the relations of the two valves.  
*Fig. 1, d.* A young individual of the same species.  
*Fig. 1, e.* Magnified view of the spines and tubercles on an adult specimen, to show their arrangement. Illinois State Collection.

*Section VII.*

PRODUCTI CAPERATI.

*P. MURCHISONIANUS*, *de Koninck*.—De Koninck "On the Genus Productus." Pl. XVI., fig. 3.

*Geological Position and Localities*.—Devonian limestones of the Devil's Back Bone, Illinois; and upper Silurian beds of Madison, Indiana. Illinois State Collection.

*P. SUBACULEATUS*, *Murchison*.—De Koninck "On the Genus Productus." Pl. XVI., fig. 4.

*Geological Position and Localities*.—Devil's Back Bone, Illinois; Graham Creek and Lewis Creek, Indiana, in Devonian limestone. Illinois State Collection.

*P. NEBRASCENSIS*, *D. D. Owen*.—"Report of a Geological Survey of Minnesota," etc. Tab. V., fig. 3, p. 584.

*Locality*.—Crossing of the Big Nemahaw, Nebraska Territory. H. Pratten's collection.

*P. GRANULOSUS*, *Phillips*.—"Geology of Yorkshire," vol. ii., p. 216. Pl. VIII., fig. 15; and de Koninck's "Monograph" on the genus, p. 135, pl. XVI., fig. 7, *a, b, c*.

We have received this shell from Mr. Worthen, who found it at Nauvoo, Illinois, and from Jas. Husbands, who found it at Carrsville, Kentucky. It occurs at both localities in the mountain limestone. At Nauvoo, in the middle portion of the series; at Carrsville in the upper part.

Tabular View of the Products in the Western States and Territories of North America.

Species.	Authors and References.	Silurian.	Devonian.	Mount. Lime.	Coal Measures.	Other Countries.			
						Silurian.	Devonian.	Mount. Lime.	Coal Measures.
<i>P. margaritaceus.</i> <i>flexistria.</i> <i>Cora.</i>	Phillips, 1836. Geol. of Yorksh., vol. II. p. 215. McCoy, 1844. Syn. of the foss. of Ireland, p. 109. A. d'Orbigny, 1842. Paleont. du voy. en Amér. mér. p. 55.					Twelve miles N. W. of Richmond, Mo. Chester, Kaskaskia, Liberty, Pope co., Illinois. . . .			* Belgium, Ireland, Yorkshire. Belgium, Ireland, Ural.
<i>Phillipsii.</i> <i>Altonensis.</i> <i>undiferus.</i>	Norwood and Pratten. . . . . Norwood and Pratten. . . . . De Koninck, 1846. Mém. de la Soc. Roy. de Liège, IV. 153. . . . .					* Warsaw, Chester, Ill; three miles East of Paris, Mo.; Carrsville, Ky. . . . . Big Cañon of Humboldt river, Utah Territory. Alton, Illinois.			* Belgium, England, Ireland, Russia, Spain, [Bolivia.
<i>Rogersii.</i> <i>clavus.</i> <i>Boliviensis.</i>	Norwood and Pratten. . . . . A. d'Orbigny, 1842. Paleont. du voy. en Amér. mér. p. 52. . . . .					* Caseyville, Illinois; Posey co., Indiana. . . . . Huntsville, Missouri. Grayville, Illinois.			* Belgium.
<i>semireticulatus.</i>	Martin, 1809. Petrif. Derb. p. 7. . . . .					Twelve miles N. W. of Richmond, Mo. . . . . Warsaw, Caseyville, Pope co., Rosiclare, Ill.; Buzzard's Roost, Ala.; Burlington, Keokuk, Iowa; Posey co., Ind.			Bolivia, Russia?
<i>carbonarius.</i> <i>costatus.</i>	De Koninck, 1843. Deser. des an. foss. Belg. p. 181. Sowerby, 1827. Min. Conch. vol. VI., p. 115.					Fountain Bluff and Pope co., Illinois. . . . . Caseyville, Ill.; 42 miles N. W. of Richmond, Charboniere, Mo. . . . .			* Belgium, Germany, Russia, England, Ire- land, Spain, South America, Australia. Belgium, Russia.
<i>Flemingii.</i>	Sowerby, 1812. Min. Conch. vol. I., p. 155. . .					Pope co., Ill.; Burlington, Iowa; Leavenworth, Ind.; three miles East of Paris, Mo. . . . .			* Russia, England, Ireland.
<i>muricatus.</i>	Norwood and Pratten. . . . .					* Fish-Hook Creek, Pike co., Ill.; six miles N. W. of Rich- mond, Mo.			* Belgium, Germany, England, Ireland, [Russia, Bolivia.
<i>Portlockianus.</i> <i>splendens.</i>	Norwood and Pratten. . . . . Norwood and Pratten. . . . .					* Charboniere, Mo. Galatia, Illinois; Posey co., Ind. six miles West of Rich- mond, Mo.			
<i>elegans.</i> <i>Wahashensis.</i> <i>Villiersi.</i>	Norwood and Pratten. . . . . Norwood and Pratten. . . . . A. d'Orbigny, 1842. Paleont. du voy. en Amér. mér. p. 53. . . . .					* Chester, Illinois. Auburn, Illinois; Posey co., Indiana.			Bolivia.
<i>scabriculus.</i>	Martin, 1809. Petrif. Derb., p. 8. . . . .					* Belleville, Ill.; Keg Creek, Mo.; Posey co., Ind. . . . . Twelve miles West of Vandalia, Caseyville, Ill.; Char- boniere, Huntsville, Mo.; Posey co., Ind. . . . .			* Belgium, France, Ireland, England, [Russia.
<i>Prattenianus.</i> <i>Hildrethianus.</i> <i>Nebrascensis.</i>	Norwood. . . . . Norwood and Pratten. . . . . D. D. Owen, Rep. of Geol. Surv. of Minnesota, etc., p. 581. . . . .					* Big Nemahaw river, Nebraska Territory. Charboniere, Missouri.			
<i>Leuchtenbergensis.</i>	De Koninck, 1817. Mém de la Soc. Roy. de Liège, IV., p. 226. . . . .					* Bellevue, Missouri river, Nebraska; Big Nemahaw river, Nebraska.			Visé, Belgium.
<i>Punctatus.</i>	Martin, 1809. Petrif. Derb., p. 8. . . . .					* Mason's Landing, Jersey co., Ill. . . . . Chester, Warsaw, Pope co., Ill.; Burlington, Keokuk, Iowa; 12 miles N. W. of Richmond, Charboniere, Mo.			* Belgium, Russia, England, Ireland, Spain. Belgium, England, Germany, Ireland, Visé, Belgium.
<i>fimbriatus.</i> <i>Buchianus.</i> <i>alternatus.</i> <i>Murchisonianus.</i>	Sowerby, 1824. Min. Conch., vol. V., p. 85. De Koninck, 1847. Anim. foss., p. 129. . . . . Norwood and Pratten. . . . . De Koninck, 1846. Mém. de la Soc. Roy. de Liège, IV., p. 245. . . . .					* Posey co., Ind. . . . . Rocky Run, Hancock county, Illinois.			Belgium, Germany, England, Russia, Australia.
<i>subaculeatus.</i>	Murchison, 1840. Bull. de la Soc. Geol. de France, vol. XI., p. 255. . . . .					* Devil's Back Bone, Illinois; Madison, Indiana. . . . . Devil's Back Bone, Illinois; Graham's Creek, Lewis' creek, Indiana. . . . .			Belgium, Germany, France, England, Russia.

ART. II.—*Notice of the genus CHONETES, as found in the Western States and Territories with descriptions of eleven new species.* By JOSEPH G. NORWOOD and HENRY PRATTEN, of the Illinois Geological Survey.

This genus was established by FISCHER in 1837, to separate from the genus *Leptæna* such shells, having the same general form with those of DALMAN'S genus, as possess a row of spines on the margin of the dorsal valve along the cardinal area. At that time there were six species known. Up to the year 1843, other species were added by European Geologists; and, in that year, our most distinguished palæontologist, Professor HALL, described two from this country, *C. cornuta* and *C. setigera*, which he united to the genus *Strophomena* of RAFINESQUE. In 1847 M. DE KONINCK published his excellent Monograph on the genus, in which he not only enumerated, but described every known species, amounting, in all, to twenty-three, including all those known in this country. Since then, in 1852, Dr. D. D. OWEN described a new species from Missouri, making all the known published species, up to the present time, amount to twenty-four. The two species already mentioned as described by Prof. HALL, belong to New York; the third one, described by M. DE KONINCK, the *C. Shumardiana*, is from Kentucky, and named by him in honor of the zealous geologist and palæontologist who discovered it.

We now make known eleven new species from our Western States and Territories, and announce the discovery of two others of the known species of Europe in our western formations, viz: *C. armata*, of M. BOUCHARD, and *C. Sarcinulata*, of SCHLOTHEIM.

Six of these species were found at a single locality, the "Devil's Backbone," in Illinois, in limestone belonging to the Devonian period; one, two miles west of Jonesboro, Illinois, in limestone of the same age; two, in the Mountain limestone of Burlington, Iowa; four are from the coal measures; and one, the *Flemingii*, is from a formation, the age of which has not yet been determined, but which, probably, belongs to the Coal period. It was found by Mr. Pratten ten miles northwest of Richmond, Missouri.

The whole number of species known to M. DE KONINCK, in 1847,	23
Added by Dr. D. D. OWEN, (U. S. Geological Survey,)	1
Addition made now,	11

Making the present number known,	35
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Seventeen of these species occur in the Western States of Northern America. To these add the two species found in New York, and we have nineteen species found in



our country, four of which are common to the United States and Europe; and fifteen, as at present known, peculiar to this continent. We must say, however, that there is still another species, brought from the Humboldt river, in Utah, the markings of which are too much obliterated to admit of its being described. It belongs to the Mountain limestone, and is, from its form, evidently distinct from any other one of our species. It was found by Mr. Pratten.

Genus CHONETES, *Fischer*.

C. SHUMARDIANA, *de Koninck*.—De Koninck's "Monograph on the Genus Chonetes." Pl. XX., fig. 1.

*Geological Position and Locality*.—In the mountain limestone at Button-mould Knob, Jefferson county, Kentucky.

C. GRANULIFERA, *D. D. Owen*.—"Geological Report of Wisconsin, Iowa and Minnesota." Tab. V., fig. 12.

*Geological Position and Locality*.—In the coal measures at Belleville, Illinois; and at Keg Creek, Missouri.

C. SMITHII, *nob.*—Pl. II., fig. 2, *a, b, c*.

Shell of medium size; transverse, having its greatest breadth on the cardinal border, which is produced into points. Dorsal valve covered with numerous fine ribs, amounting to about 160 on the margin. It is crossed by broad imbricated folds, marking the successive periods of growth, and showing that its form was the same in all stages. The entire surface is covered with small pits or hollows, as if from the falling off of tubes or spines; these pits are tolerably regularly disposed in quincunx; they are always on the summit of the ribs, and are larger and altogether different in shape from the hollows at the bottom of the furrows between the ribs; these latter being merely fine lines as if drawn by the most delicate graver. It has a wide shallow sinus, which originates at the beak, and goes on increasing in breadth to the front. The area is very large and formed by both valves; the portion belonging to the dorsal valve being hollowed, while that of the ventral valve is flattened. The deltoid aperture is wide but nearly filled by the tooth of the ventral valve. Ears distinctly separated from the dorsal vault by a wide depression. The cardinal edge has ten tubes on each side of the beak. The ornaments of the ventral valve are like those of the opposite one. On the internal surface of the ventral valve there is a bifid median tooth resting in a socket, and supported by five ridges projecting into the shell, the two largest of which are nearly parallel to the cardinal border; at a small distance from it, the central ridge projects about two fifths across the valve; on each side of this are two others supporting a series of points. All the interior surface, but particularly towards the front, is covered with small points.

*Dimensions*.—Length, 15 millimetres; breadth, 22.

*Geological Position and Locality*.—This species occurs in the shales of the coal measures, at Belleville, Illinois.

*Explanation of the Figures*.—Pl. II., fig. 2, *a*. View of the dorsal valve.

*Fig. 2, b*. Ventral aspect and area of the same.

*Fig. 2, c*. Longitudinal section of the same individual.

This species is dedicated to the memory of William Smith, the father of stratigraphical palæontology. Illinois State Collection.

C. FISCHERL.—*nob.*—Pl. II., fig. 3.

Shell of medium size; transverse, having its greatest breadth at about one third the distance between the cardinal border and the front margin. Dorsal valve slightly but regularly convex. Ears not separated by a depression from the dorsal vault. It has no ribs, properly so called, but in place of them the surface is covered with an innumerable quantity of extremely fine striæ, which radiate from the beak. These striæ are crossed by concentric ones equally fine, giving it the appearance of fine net work. There are five long thick tubes on each side of the beak, which project in nearly straight lines backwards from the shell.

Area and ventral valve unknown.

*Dimensions*.—Length, 20 millimetres; breadth, 30.

*Geological Position and Locality*.—This shell occurs at Burlington, Iowa, in beds which are considered to be at the base of the mountain limestone. It is named in honor of the founder of the genus. Illinois State Collection.

*Explanation of the Figure*.—Pl. II., fig. 3. View of the dorsal valve.

C. LITTONI, *nob.*—Pl. II., fig. 4, *a, b, c*.

Shell small; slightly transverse, having its greatest breadth near one third of the distance from the cardinal border to the front margin. Dorsal valve very convex and furnished with remarkably fine ribs, which number about 120 on the margin. Area contracted and hollowed out of both valves; deltoid aperture very narrow. On the cardinal edge we can see the traces of tubes without being able to count them. Ventral valve very concave, leaving but a small space for the lodgment of the animal. Ribs like those of the other valve.

*Dimensions*.—Length, 15 millimetres; breadth, 20.

*Geological Position and Locality*.—This species occurs at the Devil's Backbone, Illinois, in Devonian limestone. Dedicated to Prof. A. Litton, of St. Louis, Missouri. Illinois State Collection.

*Explanation of the Figures*.—Pl. II., fig. 4, *a*. View of the dorsal valve.

*Fig. 4, b*. View of the ventral valve and area.

*Fig. 4, c*. Longitudinal section.

*C. FLEMINGII*, *nob.*—Pl. II., fig. 5, *a*, *b*, *c*, *d*, *e*.

Shell rather small; depressed; transverse, having its greatest breadth on the cardinal border. Dorsal valve covered with a great number of slender, filiform ribs, which frequently bifurcate and amount, when they reach the free borders of the shell, to about 150. It is provided with a tolerably deep and wide sinus. The area is formed at the expense of both valves. Deltoid aperture rather wide. Ears somewhat flattened, and separated from the dorsal vault by a very decided depression. Cardinal edge ornamented by seven tubes on each side of the beak, which are directed obliquely. In the furrows between the ribs are numerous shallow depressions, as represented in the magnified view of a portion of the shell, Pl. II., fig. 6, *e*. The ventral valve is furnished with a varix, corresponding to the sinus of the opposite one. Its ribs are like those of the other valve, but become obliterated on the ears.

*Internal part of the dorsal valve.*—There is a strong ridge projecting from the beak towards the middle of the shell; on each side of which there is a large and deep depression. Most of the remaining surface is covered with large granulations, which, however, stop short of the free margin of the shell. Around this may be seen a series of ribs corresponding to the furrows between the exterior ribs, and showing a series of fine granulations, which answer to the small depressions of the exterior.

*Dimensions.*—Length, 10 millimetres; breadth, 17.

*Geological Position and Locality.*—It is found in beds of shale, ten miles North West of Richmond, Missouri. The age of the beds has not yet been determined.

*Explanation of the Figures.*—Pl. II., fig. 5, *a*. View of the dorsal valve.

*Fig. 5, b.*—View of the ventral valve and area of the same specimen.

*Fig. 5, c.* Longitudinal section of the same.

*Fig. 5, d.* Interior of the dorsal valve.

*Fig. 5, e.* Magnified view of a portion of the shell.

*C. VERNEUILIANA*, *nob.*—Pl. II., fig. 6, *a*, *b*, *c*.

This is one of the most singular species of the genus. It is small, transverse, having its greatest breadth on the cardinal border. Its beak is much larger and higher than that of any of our other Chonetes. An extremely deep sinus extends from the beak, bordered on each side by a high ridge; outside of which there is another sinus separating the ridges from the ears, which are a little rounded and much extended. Its surface is covered with about 100 ribs, very fine and dichotomous. Area tolerably large, and formed at the expense of both valves. Deltoid aperture very wide. Cardinal edge with four tubes on each ear, directed obliquely. The ventral valve is furnished with a very decided varix, corresponding to the sinus of the opposite valve. Its ribs are like those of the dorsal valve.

*Dimensions.*—Length, 7 millimetres; breadth, 12.

*Comparisons and Differences.*—The depth of the sinus and the height of the ridges alongside of it, will at once distinguish it from all other species. It is true that, while young, it may be mistaken for the *C. Flemingii*; but even then its sinus is deeper than in that species, and it has only four spines on the cardinal edge on each side of the beak, while the *Flemingii* has seven.

*Geological Position and Locality.*—This species occurs at Charboniere, Missouri, in the calcareous clays of the coal measures. We dedicate this species to M. de Verneuil. It will at once recall to every one the *Productus*, which bears his name, as they are both possessed of a remarkably deep sinus. Illinois State Collection.

*Explanation of the Figures.*—Pl. II., fig. 6, *a*. View of the dorsal valve.

*Fig. 6, b*. Ventral valve and area of the same specimen.

*Fig. 6, c*. Longitudinal section of the same.

*C. MESOLOBA, nob.*—Pl. II., fig. 7, *a, b, c*.

Shell small; transverse, sub-rectangular. Dorsal valve covered with extremely fine ribs, which, on the margin, number 150. They are everywhere crossed by equally fine concentric striæ. This valve is furnished with a very wide median sinus, originating near the beak, from which it goes on increasing in width to the front margin. From the bottom of this sinus rises a rounded fold of the same shape as the sinus itself; that is, it is pointed towards the beak, widening from thence to the front, so that its outline is triangular, the base being at the front of the shell. Ears small, and separated from the dorsal vault by a well marked depression, giving to the front of the shell the appearance of being formed of three lobes, separated from one another by the median sinus. Area rather large, and formed from both valves. Deltoid aperture nearly closed by the tooth of the ventral valve. The cardinal edge bears seven oblique spines on each side of the beak.

*Ventral Valve.*—Its ribs are like those of the other valve. It has a well defined middle sinus corresponding to the raised fold of the dorsal valve. On each side of this sinus it has a sharp fold opposite to the bottom of the sinus of that valve.

*Dimensions.*—Length, 8 millimetres; breadth, 11.

*Comparisons and Differences.*—At present there is no species of Chonetes known, with which this one can be confounded; no other one having a medial fold rising from the bottom of the sinus of the dorsal valve.

*Geological Position and Locality.*—This species occurs in the limestones and shales of the coal measures; at Belleville, Illinois; and at Charboniere, Missouri. Illinois State Collection.

*Explanation of the Figures.*—Pl. II., fig. 8, *a*. View of the dorsal valve.

*Fig. 8, b*. View of the ventral valve and area.



*Fig. 8, c.* View of the dorsal valve divested of its outer coating, and showing the numerous pits distributed over it.

*C. MACLUREA, nob.*—Pl. II., fig. 8, *a, b, c.*

Shell somewhat large; depressed; transverse, having its greatest breadth near its middle. At five millimetres from the beak the ribs number about thirty; at one third of the distance from the beak to the margin, most of them bifurcate. Between this and the margin several of them divide again, and when they reach it, they number about one hundred. The furrows between the ribs are of the same size as the ribs themselves. On the internal mould of the dorsal valve, the central furrow is larger than those on the right and left of it, evidently caused by a median tooth, which, commencing at the cardinal edge, traverses more than two-thirds of the length of the shell. On each side of the beak there are eight spines, directed obliquely. The ventral valve is slightly concave. Its surface is similar to that of the opposite one.

*Dimensions.*—Length, 22 millimetres; breadth, 32.

*Geological Position and Locality.*—This species was found at the "Devil's Backbone," Illinois, in limestones of the Devonian period. Illinois State Collection.

We have great satisfaction in being able to dedicate this beautiful species to the memory of William Maclure, the munificent patron of science, and the father of American geology.

*Explanation of the Figures.*—Pl. II., fig. 1, *a.* View of the dorsal valve.

*Fig. 8, b.* Same, showing the ventral valve and area.

*Fig. 8, c.* Longitudinal section of the same.

*C. VARIOLATA, A. d'Orbigny, sp.*—De Koninck's "Monograph on the Genus CHONETES." Pl. XX., fig. 2.

*Geological Position and Locality.*—Guernsey, Ohio, in coal schists.

*C. ARMATA, Bouchard.*—De Koninck's Monograph. Pl. XX., fig. 14.

*Geological Position and Locality.*—Devonian, "Devil's Backbone," Illinois.

*C. NANA, de Verneuil.*—De Verneuil's "Russia and the Ural Mountains."

*Geological Position and Locality.*—Devonian, Falls of the Ohio.

*C. SARCINULATA, Schlotheim sp.*—De Koninck's Monograph. Pl. XX, fig. 15.<sup>1</sup>

*Geological Position and Locality.*—Devonian, "Devil's Backbone," Illinois.

*C. TUOMYL, nob.*—Pl. II., fig. 9, *a, b, c.*

Shell small; depressed; transverse, having its greatest breadth near the middle of the shell. Area excavated mostly at the expense of the dorsal valve. Deltoid aperture small, open; the tooth of the ventral valve fitting into it and partially filling the aperture. The dorsal valve is but slightly convex; the ventral valve is still more

slightly concave, leaving but a very small space for the lodgment of the animal. The cardinal edge has six tubes on each side of the beak. Its surface is covered with rather large ribs, which become nearly obliterated on the ears. The ears are small and somewhat flattened. At the distance of five millimetres from the beak there are 12 ribs in the space of five millimetres, and the same number in the same space on the margin; they are fourteen in number when they leave the beak, but increase by bifurcation, so that when they arrive at the margin there are nearly sixty.

*Ventral valve.*—Its ribs are in all respects like those of the dorsal valve.

*Dimensions.*—Length, 12 millimetres; breadth, 15.

*Geological Position and Locality.*—This species occurs in the Devonian limestones of the Devil's Backbone, Jackson county, Illinois. Illinois State Collection.

*Explanation of the Figures.*—Pl. II., fig. 9, *a*. View of the dorsal valve.

*Fig. 9, b*. View of the ventral valve and area.

*Fig. 9, c*. Longitudinal section.

*C. MARTINI, nob.*—Pl. II., fig. 10, *a, b, c*.

Shell of medium size; depressed; transverse; sub-quadrangular; the cardinal border being, in a slight degree, the broadest portion of the shell. Dorsal valve somewhat convex, and covered with tolerably large ribs, which bifurcate two or three times before attaining the margin, where the whole number amounts to eighty. It has a wide but shallow sinus, which originates near the beak, and gradually widens as it proceeds towards the front. Ears flattened. Area unknown. The cardinal edge has eight thick blunt tubes on each side of the beak.

The ribs of the ventral valve are like those of the opposite one. On its internal surface it has a cardinal tooth supported on four plates, which project inwardly, and appear to be formed by the union of several ribs. The two plates nearest the cardinal edge are much the largest. The internal ribs, which correspond to the external furrows, show a series of granulations, but they are farther apart than in most of the species of the genus.

*Dimensions.*—Length, 22 millimetres; breadth, 25.

*Ribs.*—There are, on the margin, eleven in the space of five millimetres.

*Comparisons and Differences.*—This species differs from the *C. Maclurea* in its more quadrangular shape, in the smaller number of its ribs, and in the possession of a sinus, (that species having none.) From the *Tuomyi* it differs in its sinus, in the greater number of its ribs, and in having eight tubes on each side of the beak, while the *Tuomyi* has but six.

*Geological Position and Locality.*—This species occurs in the Devonian limestones of the Devil's Backbone, Illinois. Illinois State Collection.

*Explanation of the Figures.*—Pl. II., fig. 9, *a*. View of the dorsal valve.

*Fig. 9, b.*—Internal surface of the ventral valve of another specimen of the same age.

*Fig. 9, c.*—Curvature of the dorsal valve.

*C. KONINCKIANA, nob.*—Pl. II., fig. 11, *a, b*.

Shell small; depressed; transverse, having its greatest breadth on the cardinal line. Dorsal valve slightly convex; no sinus; covered, with the exception of its ears, with fine dichotomous ribs, numbering twenty-two near the beak, and fifty on the margin. The furrows between the ribs are of about the same size as the ribs themselves. Ears flattened; and without ribs. Area unknown. The cardinal edge has two spines on each side of the beak, placed near the extremities, which project slightly from the edge and then turn downwards, and run nearly parallel with it. The lower ones, which appear like a continuation of the edge, project three-tenths of an inch beyond it. Ventral valve concave, leaving a very small space for the lodgment of the animal. Its ribs are like those of the dorsal valve.

*Dimensions.*—Length, 11 millimetres; breadth 17.

*Ribs.*—At the margin there are sixteen in the space of five millimetres.

*Comparisons and Differences.*—This species can, on account of the length and peculiar direction of its spines, not be confounded with any other.

*Geological Position and Locality.*—It occurs in Devonian limestone, two miles west of Jonesboro', Union county, Illinois. Illinois State Collection.

This very curious species is named in honor of M. de Koninck, whose admirable "Monograph" on the genus is known and appreciated by every geologist.

*Explanation of the Figures.*—Pl. II., fig. 11, *a*. View of the dorsal valve, with its spines.

*Fig. 11, b.* Curvature of the dorsal valve.

*C. LOGANI, nob.*—Pl. II., fig. 12, *a, b, c*.

Shell small; transverse; having its greatest breadth near the cardinal border. Dorsal valve inflated; without a sinus; covered with about thirty rugose ribs. Ears small, and scarcely separated from the dorsal vault. Beak rather large and recurved. Ribs flattened, and crossed by fine lines. Many of them are dichotomous. Area and ventral valve unknown. Traces of tubes can be seen on the cardinal edge, but the number cannot be ascertained.

*Dimensions.*—Length, 6 millimetres; breadth, 9.

*Comparisons and Differences.*—This species differs from the *C. minuta* of Goldfuss (sp.) in the number of its ribs, that species having but twenty-two while ours has thirty. In other respects it resembles it.

*Geological Position and Locality.*—This fossil is found at Burlington, Iowa, in the middle portion of the mountain limestone series. Illinois State Collection.

We inscribe this very beautiful fossil with the name of Mr. Logan, Chief of the Geological Survey in the British Provinces of North America, on account of our high appreciation of his labors in a geological field in which we spent some years.

*Explanation of the Figures.*—Pl. II., fig. 12, *a*. View of the dorsal valve of an adult specimen, magnified.

*Fig. 12, b.* Curvature of the dorsal valve.

*Fig. 12, c.* Length of the shell.

Table of the Chonetes found in the Western States and Territories of North America.

Species.	Authors and References.	Silurian.	Devonian.	Mount. Lime.	Coal Measures.	Localities in the Western States and Territories of North America.	Localities Elsewhere.
<i>Section Comataæ.</i>							
1 C. mesoloba.	Norwood and Pratten. . . . .				*	Belleville, Illinois; Charboniere, Missouri.	
2 Flemingii.	Norwood and Pratten. . . . .				*	Ten miles North West of Richmond, Missouri.	
3 Fischeri.	Norwood and Pratten. . . . .					Burlington, Iowa.	
4 Verneuiliana.	Norwood and Pratten. . . . .				*	Charboniere, Missouri.	
5 Smithii.	Norwood and Pratten. . . . .				*	Belleville, Illinois.	
6 Maclurea.	Norwood and Pratten. . . . .				*	Devil's Backbone, Illinois.	
7 granulifera.	D. D. Owen, Geol. Rep. of Wisconsin, Iowa, and Minnesota. Tab. V., fig. 12. . . . .		*		*		
8 Shumardiana.	De Koninck. Monograph, Pl. XX., fig. 1.					Belleville, Illinois; Keg Creek, Missouri.	
<i>Section Striatæ.</i>							
9 C. variolata.	A. d'Orbigny, sp. Paléont. du voyage dans l'Amér. mérid. Pl. IV., figs. 10, 11. . . . .				*	Buttonmould Knob, Jefferson co., Kentucky.	
10 Tuomyi.	Norwood and Pratten. . . . .				*	Guernsey, Ohio. . . . .	Belgium, Russia, England, Ireland, New Holland, Bolivia.
11 Martini.	Norwood and Pratten. . . . .		*			Devil's Backbone, Illinois.	
12 Koninckiana.	Norwood and Pratten. . . . .		*			Devil's Backbone, Illinois.	
13 Littoni.	Norwood and Pratten. . . . .		*			Two miles west of Jonesboro', Illinois.	
14 armata.	Bouchard. De Koninck's Monograph. Pl. XX., fig. 14. . . . .		*			Devil's Backbone, Illinois.	France.
15 sarcinulata.	Schlotheim, sp. De Koninck's Monograph. Pl. XX., fig. 15. . . . .		*			Devil's Backbone, Illinois.	Germany, England.
16 nana.	De Verneuil. Russia and the Ural mountains. Pl. XV., fig. 12. . . . .		*			Falls of the Ohio. . . . .	Russia.
<i>Section Rugosæ.</i>							
17 C. Loganii.	Norwood and Pratten. . . . .				*	Burlington, Iowa.	



ART. III.—*Contributions to South American Herpetology.*

By EDWARD HALLOWELL, M.D.

STENODACTYLUS, *Fitzinger.*

*Gen. char.*—Fingers cylindrical, pointed at the end, with denticulated edges, and granulated inferiorly. (Dum. et Bib.)

STENODACTYLUS FUSCUS, *nob.*

*Sp. char.*—Of a dark brown color, or lighter, with numerous black spots; below light yellow; no femoral or anal pores; five plates along the margin of the lower jaw on each side; granulations of back small, uniform.

*Dimensions.*—Length of head and body,  $1\frac{1}{2}$  to  $1\frac{1}{2}$  inch; tail mutilated.

*Habitat.*—Nicaragua. Numerous specimens.

MICROPHIS.

*Char.*—Head of moderate size, short, depressed in the middle, covered with nine plates; snout rounded; nostrils between the nasal and anterior frontal plates; a frenal; one antocular; two posterior oculars; seven superior labials, the eye resting on the third and fourth; eyes of moderate size, pupil round; supraciliary plate not projecting over the eye; tail of moderate length.

MICROPHIS QUINQUELINIATUS, *nob.* Pl. III.

*Sp. Char.*—Head, body and tail, above, ash color; five dark blue stripes extending from the occiput to the base of the tail, the three intermediate ones broader than the lateral; the other stripes prolonged upon the tail, the middle one to near its extremity; 17 rows of smooth quadrangular scales; 170 abdom. scuta; two bifid preabdom.; 33 subcaudal.

*Dimensions.*—Length of head 6-8ths inch; breadth posteriorly 4-8ths inch; length of body 17 inches; of tail 2 inches 5-8ths; circumference 1 inch 3-8ths; total length 1 foot 8 inches 3-8ths.

*Habitat.*—Honduras, South America. Two specimens presented to the museum of the Academy, by Dr. Woodhouse.

*Gen. Remarks.*—This serpent has the general characters of *coronella*, but the nostrils open between the anterior frontal and nasal plates, instead of the nasal and internasal, the two being fused into one plate. We have, therefore proposed for it the generic name given above, although not disposed to attach much importance to minor considerations of this kind in the determination of genera.\*

ZAMENIS, *Wagler*.

*Gen. char.*—Head oblong, quadrate; nostrils between two nasal plates; two posterior oculars; one loreal; supraciliary plates projecting over the eye; vertical scute narrow; trunk long, equal, rounded; scales numerous, homogeneous, lanceolate, smooth; tail long. (*Wagler*.)

ZAMENIS TRICOLOR, *nob.* Pl. IV.

*Sp. char.*—Head depressed, of moderate size; snout rounded; nostrils between two nasals; a frenal, more or less quadrilateral; one antocular; two posterior oculars, the superior the larger; nine superior labials, the inferior margin of the eye resting on the fifth and sixth; neck contracted; body slender, thicker in the middle, with seventeen rows of scales, the four or five inferior rows for the most part smooth, the rest very slightly carinated; tail of moderate length.

*Coloration.*—This serpent is very remarkable for its beauty; the ground color of each scale is a deep slate color, with a yellow longitudinal line in the middle, not extending the whole length of the scale; the anterior and posterior borders of each scale bordered with light blue; under surface straw color. Abdom. scut. 148; 1 pre-abdom. scut., bifid; 75 subcaudal.

*Dimensions.*—Length of head, 1 inch; greatest breadth,  $\frac{1}{2}$  inch; length of body, 18 inches; circumference at middle, 2 inches; length of tail,  $8\frac{1}{2}$  inches.

*Habitat.*—Honduras, Central America. This specimen was recently brought from Honduras by my friend Dr. Samuel Woodhouse. One is at once struck with the beauty of this serpent. In its general appearance it resembles somewhat the *Zamenis viridi-flavus*, of which we have a very fine specimen in the Academy, found by me in the Pyrenees,—but their great dissimilarity is readily observed on placing the animals in juxtaposition. The markings of the head and sides are altogether different; in *viridi-flavus* the eye rests upon the fourth and fifth labials, and not upon the fifth and sixth, but the number of plates about the head is nearly the same, and there is no great variation in the form.

\* Proceed. Acad. Nat. Sci., June, 1854.

ELAPOIDIS, *Boie*.

*Gen. char.*—Teeth small; head not distinct from body, elapsoid; opening of the mouth moderate; nostrils and eyes lateral, the latter minute, the former widely open; vertical scute very broad, rhombic, the posterior frontals extended as far as the eyes; supraciliaries small; loreal plate oblong, taking the place of the anterior orbital; trunk cylindrical; tail acute. (*Boie*.)

ELAPOIDIS FASCIATUS, *nob.* Pl. IV.

*Char.*—Two rows of teeth in the upper jaw, one in the lower; two anterior and two posterior frontals, the former very much smaller than the posterior; a vertical, pentagonal broad and short; two small supra-oculars; two occipitals; nostrils between two plates; a long quadrangular frenal; no antocular; two posterior oculars; eyes projecting, latero-superior; pupil round; seven superior labials, the eye resting on the third and fourth; body slender, compressed laterally; neck slightly contracted; tail of moderate length, tapering to a point; nineteen rows of scales, all carinated, the carinae very distinct.

*Coloration.*—Head black above, except near the head, where it is whitish; the white spots narrow above, broad below; ground color of animal above fawn, with numerous transverse black fasciae, the greater number alternate; scales between the fasciae tipped with black; under surface straw color. Abdom. scut. 145; 1 post-abdom. bifid; 64 sub-caud.

*Dimensions.*—Length of head,  $\frac{3}{8}$  inch; of body, 7 inches; of tail,  $2\frac{3}{8}$  inches; total length,  $9\frac{1}{2}$  inches.

*Habitat.*—Honduras. Two specimens, presented by Amory Edwards, Esq.

*Gen. Remarks.*—But one species of *Elapoidis* has heretofore been described, viz.: *Elapoidis fuscus*, *Boie*, a native of Java.

ELAPS, *Schneider*.ELAPS ZONATUS, *nob.*

*Char.*—Anterior frontals much smaller than posterior; vertical short and broad; nostrils between two plates; a small loreal; one ant-orbital; two post-orbitals; five superior labials, the eyes resting on the third and fourth; eyes latero-superior; pupil round.

*Coloration.*—Head black and white, the greater part presenting above a broad black blotch extending over the temples to the posterior part of the under jaw, and over the eyes to the inferior margin of the upper, emarginate laterally; snout black, with

a white band posteriorly; thirty-eight black rings and thirty-seven white, the black rings measuring upon the sides  $\frac{1}{2}$  inch, the white  $\frac{1}{2}$ ; upon the back and abdomen the dimensions of the white rings are somewhat greater; the white rings upon the sides each dotted with small black spots; seven black bands upon the tail; fifteen rows of smooth quadrangular scales. Abdom. scut. 189; pre and post-abdom. scut. one of each, bifid; 51 bifid subcaudal.

*Dimensions*.—Head,  $\frac{5}{8}$  inch in length; breadth,  $\frac{1}{2}$  inch; length of body, 15 inches; of tail,  $2\frac{1}{2}$  inches; circumference near middle,  $1\frac{1}{2}$  in.; total length,  $18\frac{1}{2}$  inches.

*Habitat*.—Honduras. Two specimens, presented to the Museum of the Acad. Nat. Sciences, by Dr. Woodhouse.

#### ELAPS DIVARICATUS, *nob.*

*Char*.—Nothing remarkable about the plates of the head, except that the vertical is somewhat prolonged; a loral reaching to the orbit; two post-orbitars; seven superior labials, the eye resting on the third and fourth; nostrils between two plates; head narrow, depressed about half an inch in length; fifteen rows of smooth rhomboidal scales; body quite slender; tail of moderate length. Abdom. scut. 205; subcaud. 45.

*Coloration*.—Head black anteriorly and posteriorly, with an intermediate white band; thirteen crimson rings, from five-eighths to six-eighths of an inch in length, and as many black ones about three-eighths of an inch, the latter bordered each with a narrow ring of white; the red rings occupy about eight and a half rows of scales, the black three and two half rows, and the white one and a half rows of scales; the dark-colored white margined rings are therefore much less, and the intermediate crimson ones much more extended than in *E. fulvius*, and hence the name *divaricatus* which I have given it; four black and three white rings upon the tail, the yellow about half the length of the black, intermediate red spaces without dots.

*Dimensions*.—Length of head,  $\frac{1}{2}$  inch; breadth,  $\frac{5}{16}$  inch; length of body, 16 inches; of tail,  $2\frac{1}{2}$  inches; circumference, 1 inch.

*Habitat*.—Honduras. A single specimen, presented to the Museum of the Acad. Nat. Sciences, by Amory Edwards, Esq.

*Gen. remarks*.—Allied to *Elaps tenere*, Baird and Girard, from Texas: perhaps the same.

Besides the above there were received from Dr. Woodhouse a fine specimen of *Corythæolus vittatus* ♀, Kaup; *Iguana tuberculata*, Laurenti; and *Cyclura denticulata*, Wieg., from Nicaragua, and a young undetermined species of *Crotalus*, from Mr. Edwards.

ART. IV.—*Plantæ Heermannianæ. Descriptions of New Plants, collected in South California* by DR. A. L. HEERMANN, Naturalist attached to the Survey of the Pacific Railroad route, under Lieut. R. S. Williamson, U.S.A. *With remarks on other Plants heretofore described and belonging to the same collection.\**

By E. DURAND and THEOD. C. HILGARD, M. D.

#### PAPAVERACEÆ.

ARGEMONE MUNITA, *nova species*. Caulis erectus ramosus, 2½-pedalis. Tota planta glaucissima tenera et, maxime in ramis foliorumque marginibus, aculeis albis retrorsis horrens. Folia subamplexicaulia, elongato-cordata, valde repando-sinuata undulata. Flores in apicibus 3-4 conferti, breviter divaricateque pedunculati. Calyx 3-sepalus caducus setosus, quoque sepalo cornuto, cornu in aculeum validum desinente. Corolla 6-petala maxima, 3-4" diametro; petalis cuneato-obovatis, margine denticulatis, albis recte venosis. Germen lanceolato-cylindricum, aculeis rectis dense obtectum. Capsula adhuc ignota.

Stem branching, about 2½ feet high. The whole plant very glaucous and, chiefly on the stems and margins of the leaves, densely covered with strong and slightly retrorse prickles. Leaves subclasping, elongate-cordate, deeply repando-sinuate and undulate. Flowers in clusters of 3-4 on short divaricate peduncles. Calyx 3-sepalous, prickly, each sepal bearing a horn terminating in a strong prickle. Corolla 3-4" in diameter; petals six, white, veined, with slightly denticulate margins. Germ lanceolate, cylindrical, densely covered with erect prickles. Capsule unknown.

The specimens submitted to our examination are incomplete and not sufficiently advanced to determine the shape of the mature capsule and seeds. We have compared it with various forms of *A. mexicana* and with the figure of Lindley's *A. grandiflora* in Bot. Reg. T. 1264. If the latter and our plant are but varieties of *A. mexicana*, as Prof. Asa Gray thinks, they are two extreme forms of this very variable species, the one being almost unarmed and the other densely prickly. Both Lindley's and our plant bear large and beautiful white flowers; but in ours the texture is more delicate than in the *mexicana*, and the habitus of the leaves and branches is less acute, more rounded and undulating; the peduncles are shorter, stouter and more divaricate. It grows in large patches at Williamson's Pass and was in full bloom in August and September.

\* To be republished, with figures, in Lieut. R. S. Williamson's Report.



## CRUCIFERÆ.

STANLEYA INTEGRIFOLIA, Torr. in Capt. Sitgreaves' report, T. i. Posa Creek, August. Dr. Torrey's *S. integrifolia* differs from James' plant by pedicels much shorter than the stipes; in the latter, the pedicels are half as long as the stipes.

## ZYGOPHYLLACEÆ.

LARREA MEXICANA, Moric. in Gray's gen. ill. vol. ii., T. 147. *L. glutinosa*, Engelm. App. Visliz. p. 93. *Zygophyllum tridentatum*, D. C., I. Fl. Mex. A very common resinous shrub, known in the far west by the name of Kreosote plant, on account of its very strong smell. The resin of this shrub, collected by the Pimos Indians, is formed by them into balls which they kick and send before them with their feet, as they journey from one point to the other of their trail.

## MALVACEÆ.

MALVASTRUM MARRUBIODES, *nova species*.—Planta erecta circa bi-pedalis, omnino tomento stellato denso induta. Folia petiolata, late-ovata basi truncata vix triloba, crenato-dentata, subtus reticulato-venosa. Stipulæ lineares. Calyx laciniis ovato-lanceolatis acuminatis. Flores glabri rosei, in paniculis brevibus axillaribus 3-5-floris glomerati ac in spicam terminalem subsecundam desinentes.

Plant erect, about two feet high and all over covered with a dense stellate tomentum. Leaves broadly ovate, truncate at the base, subtrilobate, petiolate, crenate-dentate, reticulately veined underneath. Stipules linear. [Segments of the calyx ovate-lanceolate acuminate. Flowers smooth, rose-colored, glomerate in short panicles of 3-5 in the axils of the leaves and merging into a terminal subsecund spike. Fort Miller, July.

## LEGUMINOSÆ.

HOSACKIA LATHYROIDES, *nova species*. Herba caespitosa, basi ramosa, caulibus subflexuosis, minute pubescens. Folia imparipinnata; foliolis 5-7 lineari-lanceolatis utrinque acutis. Stipulæ rudimentariæ scariosæ, ovatæ acuminatæ. Umbellæ 1-3-floræ, bracteâ lineari-lanceolatâ in parcioribus. [Flores subsessiles 5''' longi, flavi; calycis dentibus lineari-acutis.

Herbaceous and caespitose, branching near the base, rather flexuose, minutely pubescent. Leaflets 5-7 linear lanceolate, acute at both ends. Stipules rudimentary, membranaceous, ovate acuminate; umbels 1-3-flowered; bract (only on the poorer umbels) linear-lanceolate. Flowers 5''' long, light yellow; teeth of the calyx linear lanceolate. Resembles somewhat the figure of *Lotus pinnatus*, Hook., in Bot. Mag. T. 2913, than

which, however, it has longer and narrower leaves. Fort Miller, on the banks of St. Joaquin river, August.

HOSACKIA HEERMANNII, *nova species*. *H. decumbens*, var. *glabriuscula*? Hook. and Arn. in Torr. & Gray's Fl. Vol. i. p. 324. Suffrutex sat regulariter ramulosus, omnino puberulus, 1½–2-pedalis. Ramuli in axillis umbelliferis oriundi internodiis foliorum fere longitudine. Folia imparipinnata, foliolis 3–5 alternantibus, rhomboideo-ovatis acutis mucronulatis pubescentibus, stipulis minutis rhomboideis lanugine albâ celatis, in quoque fere axillo umbellam gerentia. Umbellarum pedunculi rachidis folii fere longitudine, 2–4–6-flori foliolumque solitare ferentes. Flores subsessiles. Calyx campanulato-tubulosus pubescens, laciniis acutissimis. Corolla parva flava, petalis gracilibus obtusis apice fusco-purpurascens. Legumen pubescens, pendulum, incurvum, rostro subrefracto subulato apice uncinato vixque dimidiâ totius leguminis longitudine. Semina 1–2. Ab *H. decumbente* distinguitur formâ ramosiore ac pubescentiâ densiore, foliis mucronulatis, stipulis haud spinosis, umbellarum pedunculis multo brevioribus, flore minori apice purpurascens leguminibusque ecarinatis.

Suffruticose, pretty regularly branching, softly pubescent throughout, 1½–2 feet high; branchlets, with internodes scarcely as long as the leaves, arising in umbelliferous axils. Leaves impari-pinnate. Leaflets 3–5 rhombic ovate, acute, mucronulate, mostly alternate. Stipules minute, rhombic, tomentose; almost every axil bearing a stipitate umbel shorter than the leaf, 2–4–6-flowered with an oval bract in it. Flowers small, subsessile, yellow with purplish tips. Calyx tubulate-campanulate. Legumen 1–2 seeded, pubescent, pendulous, incurved, with a subulate uncinat and somewhat refracted rostrum. Differs from *H. decumbens* by being more branched and pubescent, by mucronate leaves, stipules not spinose, peduncles of the umbels considerably shorter, smaller flowers with purpurascens tips, and by legumes not carinate and mostly one-seeded.

#### ONAGRACEÆ.

CENOTHERA LINDLEYI, variety with light yellow petals and a violet spot above the middle. Capsules linear, attenuate at each end. Fort Miller, July.

#### CAPRIFOLIACEÆ.

SAMBUCUS VELUTINA, *nova species*. Frutex 5–6-pedalis, exceptis foliorum superiori superficie glaberrimâ floribusque velutino-tomentosus. Foliola 5–7 ovato-lanceolata, basi obliquâ semisubcordatâ in lateralibus, acuta, argute serrulata, dentium apice subscarioso, supra nitida et in sicco minute corrugata. Corymbus parvus

4-5-radiatus. Eodem tempore eodemque ramo flores, fructum immaturum maturum-que atro-rubentem, gustu grato rubique fructus simili exhibens.

Stem fruticose 5-6 feet high, densely tomentose throughout, excepting the upper surface of the leaves, which is very glabrous and slightly rugose. Folioles 5-7 ovate-lanceolate, finely serrate, coriaceous. Corymb small, 4-5-radiate. Berries deep purple when ripe, agreeable to the taste, and almost equal to the blackberry. It bears flowers, green and ripe fruit on the same branches. Posa Creek, August.

#### COMPOSITÆ.

CORETHROGYNE TOMENTELLA, Torr. & Gray's Fl., Vol. ii., p. 99. In some of our specimens with inflorescence much developed, a very striking appearance is produced by the very dense and white tomentum being abruptly replaced by a green glandular and viscous pubescence on the whole inflorescence. Leaves on the lower part of the branches linear-oblong, appressed and closely sessile; those of the top of the stem broadly obovate obtuse; those of the branches small and bract-like. Tejon Valley, September.

GUTTIERREZIA MICROPHYLLA, Gray. Pl. Fendl. p. 74, adn. *Brachyris microcephala*, D. C. Prodr. vol. v., p. 313. The inflorescence of our specimens being much advanced, we were long deceived by the almost cylindrical and loosely turbinate character of the heads of flowers which, in the genus *Gutierrezia*, are always more or less ovoid. Tejon Valley, September.

LYNOSYRIS CERUMINOSA, *nova species*. Caulis erectus 2-3-pedalis, pube substantiâ resinosa ceruminis modo infiltratâ et nitorem ochroleuco-aureum præstante obtectus; apice fastigiato-ramoso, capitulis breve pedicellatis et apice confertis corymbum sistentibus. Internodia superiorâ vix 3-4". Folia linearia subcarnosa puberula, sulco superne longitudinali, dorso rotundato; caulinarum interdum pollicaria, ramealia 3-6" longa, deorsum incurva. Squamæ involucales carinatae filiformi-mucronatae flavescentes.

Stem erect 2-3 feet high, fastigiately branched, with crowded heads on short pedicels forming a corymb. The whole surface of the stalks is covered with a short, apparently dense, tomentum infiltrated with a yellowish resinous substance, giving it a texture of ear-wax of a greenish golden hue. Internodes of the branchlets 3-4". Leaves linear, puberulent, subcarnose, rounded on the back, with a furrow on the upper surface, nearly 1 inch long on the stem,  $\frac{1}{2}$ " or less and recurved on the branches. Scales of the involucre carinate, light yellow, darkening towards the filiform mucro. Tejon Pass, September.

**LYNOSYRIS TERETIFOLIA**, *nova species*. Fruticulus ericæ facie, resinosus, balsamum canadense redolens, 8-12-pollicaris cumuliformis, fruticeta vasta sistens. Trunculi fere nudi, cortice disruptâ emarcido-grisei; ramuli ochracei resinoso-vernicati, subcorymbosi, dense foliosi; internodiis brevibus, naviculato-depressis, marginatis. Folia  $\frac{1}{2}$ -1-pollicaria filiforme-teretia obtusa, superne paucillum sulcata et, æque ac ramuli, epidermide aphthoso-scabrellâ maximeque viscido-resinosâ induta. Capitula, flava in summo spiculata subsessilia.

A small bushy shrub, covering extensive tracts of land like the common heath of Europe and presenting a corymbose summit densely set with filiform, erect, obtuse leaves, 1-1½" long, and crowded yellow heads of flowers. The lower branches are almost naked, rugose with a cracked epidermis; the upper branches, as well as the leaves, with an aphthoso-glandular resinous surface, emitting a strong smell of fir balsam. The internodes are navicularly depressed below each axil and costate by the bordering ridges. Heads of flowers subsessile, aggregated into dense terminal spikelets and clusters forming a corymb. All over the mountains, round the Tejon Valley, September.

#### APOCYNEÆ.

**APOCYNUM CANNABINUM**, Var. *lanceolatum*. Nov. var. Leaves lanceolate, acute at both ends very glabrous. River bottoms, Posa Creek, August.

#### ASCLEPIADEÆ.

**ASCLEPIAS MACROPHYLLA**, Nutt. Var. *comosa*, *nov. var.* Tota planta, exceptis pedunculis pedicellis umbellarumque involucellis pubescentibus, glaberrima glauca. Caulis gracilis bipedalis subflexuosus erectus, fronde subsecundâ, internodiis aliquoties bipollicaribus. Folia spithamæa, ad primum cujusque surculi nodum opposita, ceterum ternatim verticillata, in sicco conduplicata, marginibus haud, revolutis. Ramuli singuli vel bini in axillis, exiles, tenues, flexuosi, dense foliosi. Umbellæ binæ vel trinæ in verticellis supremis, pedunculis sesquipollicaribus, involucris lineari-bracteatis, floribus parvis, numerosis (usque ad quadraginta), mediam folii partem vix æquantes. Pedicelli dimidiâ pedunculorum longitudine. Flores virescentes, albido-marginati nec fuscii. Corollæ lobi obovati, concavi, resurgentes, margine albo. Coronæ stamineæ stipes eâdem ac lorum longitudine; lobi producti, ovati obtusi, processibus cultriformibus, cristas connectivorum albo-scariosas æquantibus.

Stem erect, slender, rather flexuose, about 2 feet high. Leaves a span long, linear, smooth, doubled up without revolute margins, in whorls of three, except at the lowest node of each shoot, where they are opposite. Internodes 2" or more long, each with one or more slim and densely-leaved branchlets, giving it a comose appear-

ance. Umbels 2-3 in each of the upper whorls, scarcely half the length of the leaf, with pedicels half the length of the peduncle and, together with the involucre bracts, somewhat tomentose. Stipe of the staminal crown about the length of its lobes, claws cultriform, erect, as high as the white tips of the connectives. Perhaps a new species?

It differs from Nuttall's description of *A. macrophylla* in Gambel's plants by its tomentose pedicels, leaves more approximated, denser umbels and the absence of brown color in its flowers. Grows abundantly in river bottoms. Posa creek, August.

#### GENTIANÆ.

ERYTHRÆA MUHLENBERGII, Grisel. in D. C. Prodr. vol. ix., p. 60. Our plant is intermediary between *E. tricantha* and *E. Muhlenbergii*, all, probably, being varieties of one species. A very showy and beautiful little plant. Fort Miller, July.

#### POLEMONIACEÆ.

GILIA ELONGATA? Stud. in D. C. Prodr. vol. ix., p. 30. Our plant differs from D. C.'s description by being scarcely puberulent, although the capitula are densely lanate; by having mostly four segments on each side of the leaves and by the tube of the corolla being much exerted. Tullary Valley, August.

#### CONVOLVULACEÆ.

CUSCUTA SUBINCLUSA, *nova species*. Flores dense glomerati subsessiles. Calyx subovatus, lobis late ovatis obtusis imbricatis. Corolla tubo cylindrico, limbo patente, deinde, germine aucto fauceque marcescente contractâ, sublageniformis. Segmenta ovata, latiora supra basim, dimidiâ tubi longitudine. Antheræ elongatæ, sub angulis subsessiles, subinclusæ. Filamenta antheris breviora. Squamellæ marginibus parallelis, maxime ad apicem fimbriatæ, conniventes. Germen biapiculato-globosum, bistyle. Styli duplo fere germine longiores, subinclusi, subinequales. Stigmata capitata.

Flowers subsessile in dense clusters. Calyx subovate, with broadly oval-obtuse and imbricated lobes. Tube of the corolla cylindrical and afterwards rather lageniform by the increase of the germ and shrinking of the fauces. Lobes of the limb ovate, broadest above the base, half the length of the tube. Anthers subsessile under the dividing angles, subincluded. Filaments shorter than the anthers. Scales parallel-sided, fringed chiefly on the top, connivent. Germ globose, bi-apiculate



with two styles about double the length of the germ, rather unequal; stigmas capitate. On a willow, Tejon Pass, September.

## SCROPHULARIACÆ.

*ANTIRRHINUM COULTERIANUM*, Benth. Var. *appendiculatum*, nova var. Differs from the description in D. C. Prodr. vol. ix., p. 592, by the shortness of the peduncles; stem simple, erect, glanduloso-pubescent, violet colored below; leaves on short petioles, ovate-lanceolate, smooth; many sterile setiform branches, bracteate at top, springing from the axils; flowers in a subsecond raceme, almost subsessile. Calyx and corolla strongly pubescent, upper segments of the calyx broadly lanceolate, the rest linear lanceolate. Perhaps a new species. Posa Creek, August.

*MIMULUS EXILIS*, nova species. Herba circa pedalis erecta gracillima, ad apicem vix paulum ramosa, exsucca, sparse villosa. Caulis teres, jam prope basim et abinde flores singulos vel oppositos pedunculis setiformibus foliaque superantibus prodens. Internodia 1–1½" longa. Folia opposita sessilia elliptico-lanceolata, ¾" longa. Calyx subangulatus subcampanulatus oblique quinquefidus, segmentis acutis, demum subinflatus. Corolla 4''' longa, flava, limbo parvo, fauce pilosâ maculatâ. Stamina inclusa. Capsula membrancea ovato-lanceolata subacuminata, calycem demum æquans. Semina parva ovata, testâ granulâtâ. Herba ab habitu generis *Mimuli* subdiversa.

A slender erect herb sparsely villous, a foot or more high, not succulent. Stem terete, filiform, a little branched near the top. Internodes 1 to nearly 2" long. Leaves sessile, elliptico-lanceolate. Peduncles setiform, longer than the leaves. Calyx oblique, subangular, deeply 5-cleft, at first campanulate and finally inflated. Corolla 4''' long, yellow, limb small, fauces pilose, spotted. Stamens included. Capsule membranaceous, ovate-lanceolate pointed, finally equalling the calyx, ½" long. Seeds small, ovate, testa granulate. Habitus rather different from that of the genus *Mimulus*. Posa creek, August.

*CASTILLEJA CANDENS*, nova species. Herba circa pedalis erecta, nonnunquam ramosa, basi glabra, supra cinereo-pubescent, bracteis calycibusque omnino-rubentibus, basi obscuris apice fulgentibus, corollis glaberrimis, maxime exertis, pallide atro-flavis cunctisque nigricante-venosis. Folia circa pollicaria, inferiora integra, linearia acuta; cætera profunde tripartita, trinervia; segmentis linearibus; floralia latiora, apicibus acuminato-lacinulatis. Calyx 1¼–1½", subinflatus bifidus, lobis acute bidentatis. Corolla fere bipollicaris striata, labio superiori sæpe pollicari, inferiori rudimentario.

Herbaceous, about a foot high and, except toward the base, grayish puberulent, especially the calyx and bracts, less so the lower surface of the leaves. Leaves 1" or

more long and, as well as their segments, linear, the lower ones entire, acute, all others tripartite, trinerved; those of the inflorescence broader and acuminate lacinulate at their apex, the upper, as well as the calyx, entirely red and darkly veined, dusky at the base, scarlet at the top. Calyx  $1\frac{1}{4}$ – $1\frac{1}{2}$ " long, subinflated bifid, each lobe acutely bidentate. Corolla nearly 2" long, of a light blackish yellow, with black veins, the lower lip rudimentary, the upper often 1" long. In river bottoms, Posa Creek, August.

#### LABIATÆ.

**TRICHOSTEMA LANCEOLATUM**, Benth. Lab. in D. C., Prodr. vol. xii., p. 573. A remarkably fragrant plant. Fort Miller, July.

#### SALSOLACEÆ.

**OBIONE BRACTEOSA**, *nova species*. Planta herbacea, 2–3-pedalis, oleracea farinoso-lepidota, monoica. Rami sulcati, apicibus masculiferis paniculatis; parte inferiori foliosâ et singulis axillis spicam foemineam bracteosam prodente. Internodia  $\frac{1}{2}$ " vel minora. Folia subglauca membranacea, sessilia, lanceolata acuminata mucronata, passim dentata vel integra, pollicaria vel minora, superne minus lepidota. Florum masculorum glomeruli globosi, in spicas laxiores, paniculum ebracteatum terminalem constituentes, dispositi. Flores foeminei in bractearum axillis glomerati; bracteae attenuatae, maxime acutatae, albido-lepidotae. Thecae immaturae 1" longae, subgloboso-lenticulares, reticulatae, marginibus foliaceis laciniatis muricatae, alatae acuteque apicatae.

An herbaceous monoicous plant, 2–3 feet high, with furrowed branches about a foot or more long. The top nearly destitute of leaves, branching into a panicle composed of simple interrupted spikes of globosely-glomerate male flowers and the lower part bearing in the axil of each leaf a bracteose spike of female flowers. Internodes  $\frac{1}{2}$ " or less. Leaves oleraceous, sessile, lanceolate acuminate, mucronate, sparsely dentate or entire, 1" or less long, rather glaucous, less lepidote on the upper surface. Female spikes crowded with attenuated and strongly pointed whitish lepidote bracts. The immature thecae orbicularly subglobose, reticulated; winged, muricated and acutely tipped with jagged leafy crests. Growing in large bushes in bottom lands. Posa creek, August.

#### POLYGONACEÆ.

**ERIOGONUM FASCICULATUM**, Nutt? A low stoutish and much branched shrub, with a brown tattered bark on the lowest branches. Leaves elliptic oblong, fasciculate and slightly revolute. Umbels compound on long peduncles. Flowers numerous, showy, whitish with red central lines. Posa Creek, September.

**ERIOGONUM ROSEUM**, *nova species*. Herba sesquipedalis erecta virgato-ramosa arachnoideo-tomentosa. Caulis bracteis parvis appressis ternatis ovato-acutis fuscorubentibus ad quemque nodum munitus; basi foliosus, dein scapiformis multumque infra medium trifurcatus, brachiis cum verticillo unico ternato, nunc ramulos ac folia prodente, alternantibus, nunc et capitulis sessilibus imæ furcæ insidentibus; abinde foliis singulis parvis solumque ad nodos ramiferos sitis. Folia anguste spathulato-ovata, margine undulata, in petiolum longum attenuata, superne rubentia, radicalia cum pedicellis 1½–2" longa. Involucra sessilia plerumque solitaria, acheniformia, tubuloso-campanulata, secundum ramos subsecunda nonnunquam et terminalia. Flores parvi exserti incarnati vel purpurei. Paleolæ florales setiformes, inclusæ.

The whole plant, except the flowers, covered with a white arachnoid tomentum. Stem about 1½ foot high, virgately branched with ternate bracts at each node, leafy at the base, hence scapiform and trifurcate below the middle, with the prongs alternate to a solitary ternate whorl of leaves, sometimes producing accessory branches and leaves from their axils, and sometimes capitula seated in the very centre of the 3-furcation; a small solitary leaf at each further ramification. Leaves narrowly spathulate, obovate, undulate at the margin, attenuate into long petioles, with a reddish tinge; radical leaves 1½–2" long including the petiole. Involucres sessile, mostly solitary, acheniform, tubuloso-campanulate, unilateral along the branches and terminal. Flowers small, glabrous, exserted, pinkish or purpurescent. Floral chaff setiform, included. Posa Creek, September.

**ERIOGONUM PLUMATELLA**, *nova species*. (Specimina incompleta.) Caulis vix pedalis, dense floccoso-tomentosus, rami divaricati, spiculis densis cum internodiis vix 3-linearibus pinnati. Folia . . . Bracteæ patentés, in spicis triangulares, in ramis oblonge-lineares obtusæ. Involucra solitaria, campanulata, segmentis rotundatis, incarnato-fusca. Flores albi lobis obovatis.

(Specimens incomplete.) Stem hardly a foot high, densely tomentose, terminating in divaricate panicles pinnate with crowded spikelets with internodes scarcely 3" long. Leaves . . . (apparently all radical.) Bracts spreading, those of the spikelets triangular, those of the branches oblong linear obtuse. Involucres solitary, campanulate, with rounded segments and of a reddish-brown color. Flowers white, with ovate lobes. Posa Creek, September.

**ERIOGONUM GENICULATUM**, *nova species*. (Specimina incompleta.) Caulis circiter pedalis, (æque ac involucra) pallide virens glaberrimusque; ramis divaricatissime furcatis. Folia . . . . . Bracteæ minutæ late triangulares, patentés. Involucra

The dorsal fin begins in a line vertical with the posterior extremity of the fleshy appendix to the opercle, and ends half an inch from the root of the caudal; it has ten slender spines, the two anterior short, and twelve branched rays which are very long. The pectoral is broad; it begins in a line with the bony opercle, and has fifteen rays. The ventral arises behind the root of the pectoral and terminates between the vent and anal fin; it has one spine and five branched rays; the anal begins opposite the first dorsal soft ray and terminates beyond the dorsal fin; it has three spines, the anterior short, the others long and stout; there are ten very long, branched rays. The caudal is large, broad, emarginate, or slightly lunated behind, and has seventeen rays.

The scales are rather small, semicircular, straight before, round and ciliated behind. The lateral line runs near the upper third of the body, and is concurrent with the dorsal arch to the extremity of the root of the dorsal fin, when it descends to the median plane.

COLOR. See *Specific Characters*.

DIMENSIONS. The distance between the tip of the opercle and the tip of the tail is equal to three heads; the greatest elevation without the dorsal fin is equal to one head and a half; total length seven inches.

GEOGRAPHICAL DISTRIBUTION. St. Johns River, Florida. The original specimen in the collection of Prof. Agassiz, at Cambridge, Massachusetts.

#### POMOTIS SPECIOSUS.

Plate V. Fig. 2.

SPECIFIC CHARACTERS. Body oval, elongated, compressed, brownish olive above, white below, with a few reddish brown spots on the sides, lateral line red, head rather small, appendix of the opercle black, bordered with red. D. 10-10. P. 14. V. 1-5. A. 3-9. C. 17.

DESCRIPTION. This fish is much more elongated in form than *Pomotis vulgaris*, and is much less arched both at its dorsal and ventral outlines. The head is of moderate size, broad between the eyes, and narrow, though rounded at the snout. The eye is very large; it is placed one diameter of its orbit from the snout, and two diameters from the extremity of the opercle, with its superior margin near the facial line, and its inferior about the middle plane of the head. The posterior nostril is large, sub-round, and near the orbit; the anterior is round, small, nearer the mesial line, and midway between the orbit and snout.

The pre-opercle is round and slightly serrated at its angle, the opercle is triangular, with a broad base in front, its apex behind truncated, and furnished with a fleshy ap-

**ERIOGONUM ROSEUM**, *nova species*. Herba sesquipedalis erecta virgato-ramosa arachnoideo-tomentosa. Caulis bracteis parvis appressis ternatis ovato-acutis fusco-rubentibus ad quemque nodum munitus; basi foliosus, dein scapiformis multumque infra medium trifurcatus, brachiis cum verticillo unico ternato, nunc ramulos ac folia prodente, alternantibus, nunc et capitulis sessilibus imæ furcæ insidentibus; abinde foliis singulis parvis solumque ad nodos ramiferos sitis. Folia anguste spathulato-ovata, margine undulata, in petiolum longum attenuata, superne rubentia, radicalia cum pedicellis  $1\frac{1}{2}$ –2" longa. Involucra sessilia plerumque solitaria, acheniformia, tubuloso-campanulata, secundum ramos subsecunda nonnunquam et terminalia. Flores parvi exserti incarnati vel purpurei. Paleolæ florales setiformes, inclusæ.

The whole plant, except the flowers, covered with a white arachnoid tomentum. Stem about  $1\frac{1}{2}$  foot high, virgately branched with ternate bracts at each node, leafy at the base, hence scapiform and trifurcate below the middle, with the prongs alternate to a solitary ternate whorl of leaves, sometimes producing accessory branches and leaves from their axils, and sometimes capitula seated in the very centre of the 3-furcation; a small solitary leaf at each further ramification. Leaves narrowly spathulate, obovate, undulate at the margin, attenuate into long petioles, with a reddish tinge; radical leaves  $1\frac{1}{2}$ –2" long including the petiole. Involucres sessile, mostly solitary, acheniform, tubuloso-campanulate, unilateral along the branches and terminal. Flowers small, glabrous, exserted, pinkish or purpurescent. Floral chaff setiform, included. Posa Creek, September.

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**ERIOGONUM GENICULATUM**, *nova species*. (Specimina incompleta.) Caulis circiter pedalis, (æque ac involucra) pallide virens glaberrimusque; ramis divaricatissime furcatis. Folia . . . . Bracteæ minutæ late triangulares, patentés. Involucra



The dorsal fin begins in a line vertical with the posterior extremity of the fleshy appendix to the opercle, and ends half an inch from the root of the caudal; it has ten slender spines, the two anterior short, and twelve branched rays which are very long. The pectoral is broad; it begins in a line with the bony opercle, and has fifteen rays. The ventral arises behind the root of the pectoral and terminates between the vent and anal fin; it has one spine and five branched rays; the anal begins opposite the first dorsal soft ray and terminates beyond the dorsal fin; it has three spines, the anterior short, the others long and stout; there are ten very long, branched rays. The caudal is large, broad, emarginate, or slightly lunated behind, and has seventeen rays.

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COLOR. See *Specific Characters*.

DIMENSIONS. The distance between the tip of the opercle and the tip of the tail is equal to three heads; the greatest elevation without the dorsal fin is equal to one head and a half; total length seven inches.

GEOGRAPHICAL DISTRIBUTION. St. Johns River, Florida. The original specimen in the collection of Prof. Agassiz, at Cambridge, Massachusetts.

#### POMOTIS SPECIOSUS.

Plate V. Fig. 2.

SPECIFIC CHARACTERS. Body oval, elongated, compressed, brownish olive above, white below, with a few reddish brown spots on the sides, lateral line red, head rather small, appendix of the opercle black, bordered with red. D. 10-10. P. 14. V. 1-5. A. 3-9. C. 17.

DESCRIPTION. This fish is much more elongated in form than *Pomotis vulgaris*, and is much less arched both at its dorsal and ventral outlines. The head is of moderate size, broad between the eyes, and narrow, though rounded at the snout. The eye is very large; it is placed one diameter of its orbit from the snout, and two diameters from the extremity of the opercle, with its superior margin near the facial line, and its inferior about the middle plane of the head. The posterior nostril is large, sub-round, and near the orbit; the anterior is round, small, nearer the mesial line, and midway between the orbit and snout.

The pre-opercle is round and slightly serrated at its angle, the opercle is triangular, with a broad base in front, its apex behind truncated, and furnished with a fleshy ap-

pendix. The sub-opercle is long and nearly of the same breadth throughout. The inter-opercle is large; the cheeks are protected by small scales, and the opercular bones by large, but the top of the head is smooth. The mouth is small; the posterior extremity of the upper jaw not reaching to the orbit. The lower jaw, and intermaxillary bones are armed, with two or three series of teeth, small, pointed, and closely set, with an outer row of larger teeth; these teeth are all similar in form to those of the last described animal, but are more minute; the vomer is furnished with a broad, and arrow-headed group of very fine teeth, and the pharyngeal bones with paved teeth, with a border of closely set, sharp pointed teeth below; and the upper pharyngeal with similar teeth in front.

The dorsal fin is long, elevated, and begins on a line with the posterior part of the origin of the pectoral, and has ten spines, the two anterior short, the others long: it has ten branched rays, more elevated than the spines. The pectoral is very long and somewhat falciform in shape; it begins on a line with the posterior margin of the bony opercle and extends beyond the root of the third anal spine, and has fourteen soft rays. The ventral begins back of the origin of the pectoral and ends behind the vent, near the anterior anal spine. The anal fin arises opposite the root of the tenth dorsal spine, or slightly behind it, and terminates with the dorsal fin behind; it has three spines, the anterior short, the others long and stout, with nine long branched rays. The caudal is large, full, lunate behind and has seventeen rays.

The scales are small, somewhat unguiform, straight before, rounded and ciliated behind, and longest in the horizontal direction. The lateral line corresponds to the arch of the back, and runs parallel with it.

COLOR. See *Specific Characters*.

DIMENSIONS. The extent from the extremity of the opercle to the tip of the tail is equal to three heads; the greatest elevation without the dorsal fin, is equal to one head and a half; the total length is seven and a half inches.

GEOGRAPHICAL DISTRIBUTION. St. John's River, Florida. The original specimen is in the collection of Prof. Agassiz, at Cambridge, Massachusetts.

#### POMOTIS MARGINATUS.

*Plate VI. Fig. 2.*

SPECIFIC CHARACTERS. Body much arched above and below; dusky olive brown above, with vertical bars of the same color extending to the median plane; yellowish below; head and sides marked, with numerous bluish green spots; appendix of the opercle bordered with green. D. 9 - 12. P. 12. V. 1 - 5. A. 3 - 10. C. 17

DESCRIPTION. This small *Pomotis* is so very convex, both at the dorsal and ventral outline, as to have a sub-round form; it is compressed, though thicker below than above. The head is large, the snout is full, rounded, and is as broad as the occiput, or the space between the eyes. The eye is of a moderate size, and is placed at less than one diameter of its orbit from the snout, and at one diameter and a half from the bony opercle, with its lower margin near the middle plane of the head. The posterior nostril is very near the orbit, and is above the median plane of the eye; the anterior is very small.

The pre-opercle is rounded and slightly serrated at its angle. The opercle is large, broad in front, and with a truncated angle behind, furnished with a broad, fleshy appendix. The sub-opercle is large, and broadest in front; the inter-opercle is also broad, and rounded below. The cheeks and opercular bones are covered with large scales, but the top of the head is smooth. The mouth is very small, the posterior extremity of the upper jaw extending only to the orbit. The lower jaw and the intermaxillary bones are armed with several series of delicate, pointed, recurved, card-like teeth; those of the outer row are the largest; there is a small, arrow-headed patch of minute teeth in the vomer. The pharyngeal bones are furnished with small, pointed straight, closely set teeth, and with a few of a larger size near their internal margin.

The dorsal fin is long and elevated; it begins at the opercle and extends nearly to the root of the caudal, and has nine delicate spines and twelve branched rays. The pectoral arises under the apex of the opercle, terminates at the vent, and has twelve rays. The ventral begins on a line with the anterior fourth of the pectoral, extends to the first anal spine, and has one spine, and five soft rays; the anterior slightly prolonged. The anal fin extends from the third dorsal soft ray, to the root of the caudal; it has three stout spines, the first short, the third longest, and ten branched rays. The caudal is large, slightly lunate behind, and has seventeen rays.

The scales are large, most extensive vertically, nearly straight before, rounded and ciliated behind. The lateral line runs near the upper fourth of the body and parallel to the arch of the back, as far as the end of the dorsal fin, and then descends to the median plane.

COLOR. See *Specific Characters*.

DIMENSIONS. The extent from the opercle, to the tip of the tail, is equal to three heads and one quarter; the greatest elevation without the dorsal fin, to one head and three quarters; total length five inches.

GEOGRAPHICAL DISTRIBUTION. St. John's river, Florida. The original specimen is in the collection of Prof. Agassiz, at Cambridge, Massachusetts.

Genus BRYTTUS, *Valenciennes*.

CHARACTERS. Body, shaped like *Pomotis*, intermaxillary, inferior maxillary, vomerine, and palatine teeth. Tongue smooth. Anal spines, three.

## BRYTTUS FASCIATUS.

Plate V. Fig. 3.

SPECIFIC CHARACTERS. Body elliptical; olive brown above, with dusky vertical bars; yellowish, with numerous crimson spots below. D. 9 - 12. P. 10. V. 1 - 5. A. 3 - 11. C. 17.

DESCRIPTION. This beautiful little fish is nearly elliptical in form, with both its ventral and dorsal outlines strongly arched. The head is flat, broad between the orbits, with the snout round and broad for the size of the head, and having several pores. The eye is very large, and is placed one diameter of its orbit from the snout, one diameter and a half from the extremity of the opercle, with its lower margin about the median plane of the head, and its upper near the facial outline, though it does not encroach upon it. The nostrils are large; the posterior and larger, is very near the orbit.

The pre-opercle is short and scarcely rounded at its angle. The opercle is large, with its broad base in front and its apex behind truncated and furnished with a fleshy appendix. The sub-opercle is very narrow, but the inter-opercle is broad. These bones, as well as the cheeks, are covered with scales, but the head above smooth. The mouth is very small, the posterior extremity of the upper jaw not reaching to the orbit. The lower jaw and intermaxillary bones are armed with a row of slender, conical, sharp-pointed, recurved teeth, and within this, is a small patch of minute, villiform teeth. The vomer and palate bones are also furnished with small groups of similar minute teeth. The pharyngeal bones are covered with paved teeth of different sizes.

The dorsal fin is long and very much elevated; it begins just behind the opercle, terminates at the caudal fin, and has nine spines, with twelve long branched rays. The pectoral is long and has ten rays. The ventral arises nearly with the pectoral, and ends with it behind; it is much elevated and has three spines and eleven soft rays. The caudal is full, slightly rounded, and has seventeen rays.

The scales are small, unguiform, though very convex behind and broadest in the vertical direction. The lateral line runs about the superior fourth of the body, and is concurrent with the dorsal arch, to the end of the root of the dorsal fin, when it descends to the median plane.

COLOR. See *Specific Characters*.

DIMENSIONS. The distance between the opercle and the tip of the tail, is equal to two heads and three quarters; the greatest elevation without the dorsal fin, is one and three quarters of a head; total length, three and a half inches.

GEOGRAPHICAL DISTRIBUTION. St. John's river, Florida.

BRYTTUS GLORIOSUS.

Plate V. Fig. 4.

SPECIFIC CHARACTERS. Body olive brown above; yellowish white below; head, body, dorsal and anal fins marked with numerous golden spots; a black blotch at the opercular appendix, and at the root of the caudal fin. D. 9-11. P. 14. V. 1-5. A. 3-10. C. 17.

DESCRIPTION. This beautiful little fish is like the last described animal, elliptical in form, arched both at the dorsal and ventral outline, although rather less so at the latter. The head is small, short, with the snout narrow, though rounded, the occiput broad, and there is no contraction between the orbits. The eye is large; it is placed one diameter of its orbit from the snout, two diameters from the angle of the opercle, with its lower margin at the median plane of the head, and its upper nearly half a diameter of the orbit from the facial outline. The nostrils are on a line within the orbit; the posterior and larger is very near the orbit, and the anterior midway between it and the snout.

The pre-opercle is short, and scarcely, if at all rounded at its angle. The opercle is small, subtriangular, its apex behind and furnished with a slight fold of skin. The sub-opercle is large and nearly of the same breadth throughout. The inter-opercle is also large, and all are covered with scales, though the top of the head is smooth. The mouth is very small; the lower jaw, and intermaxillary bones are armed with numerous, minute, villiform teeth; the vomer, and palate bones have similar teeth, but smaller.

The dorsal fin is long and much elevated, especially in its soft portion; it begins about the anterior fourth of the pectoral, or rather before it, and ends at the root of the caudal; it has nine spines, and eleven branched rays. The pectoral arises in a line vertical with the end of the opercle, and extends to the anal fin; it has fourteen rays. The ventral begins nearly in a line with the pectoral, and extends as far back; it has one spine, and five branched rays. The anal fin begins opposite the root of the second soft dorsal ray, extends to the caudal, and is full and rounded like the dorsal fin; it has three spines and ten branched rays. The caudal is large and rounded slightly; it has seventeen rays.

The scales are large, rounded and ciliated behind, and nearly straight before. The

lateral line runs along the upper fourth of the body and concurrent with the dorsal outline to the extremity of the root of the dorsal fin, when it descends to the median plane.

COLOR. See *Specific Characters*.

DIMENSIONS. The length from the extremity of the opercle to the tip of the tail is equal to three heads; the greatest elevation, without the dorsal fin, to one and a half heads; total length two inches and three quarters.

GEOGRAPHICAL DISTRIBUTION. S. Carolina, Georgia, and at Dr. Edmund Ravenel's plantation, on Cooper River.

Genus CALLIURUS, *Rafinesque*.

CHARACTERS. Body oval, rather elongated, not compressed above, spinous dorsal long, low, with a slight depression between it and the soft portion, which is shorter though higher; anal less in size than the dorsal, and with three spines; mouth large; lower jaw, longer than the upper; teeth on the intermaxillary, vomer, palatine bones and tongue.

CALLIURUS FLORIDENSIS.

Plate VI. Fig. 1.

SPECIFIC CHARACTERS. Body elongated compressed; dusky above, yellowish below, with black spots along the sides; anal and caudal fins dusky; dorsal, with a reddish brown spot at its posterior inferior margin. D. 10-10. P. 14. V. 1-5. A. 3-10. C. 17.

DESCRIPTION. This fish approaches in its general form the *Pomotis vulgaris*, though it is longer and less elevated, and is thicker, especially in front of the dorsal fin. The head is large, and though narrow between the eyes has a snout full and rounded. The eye is large and is placed one diameter of its orbit from the snout, and rather more than two diameters from the extremity of the opercle, with its superior margin at the facial line, and its inferior rather above the middle plane of the head. The posterior nostril is oval, near the eye and about its median plane; the anterior is smaller, round and midway between the eye and the snout.

The pre-opercle is rounded at the angle, with its ascending border nearly vertical. The opercle is triangular, with its basis in front, its apex behind, rounded and furnished with a very short fleshy appendix.

The sub-opercle is of nearly the same breadth throughout; the inter-opercle is broad, and both are covered with large scales, but the cheeks and opercles have small scales, and the top of the head is smooth. The mouth is large; the posterior ex-



tremity of the upper jaw reaching to the middle of the orbit; the lower jaw is the the larger, and makes part of the facial outline when the mouth is closed. The lower jaw and the intermaxillary bones are armed with small, pointed, closely set teeth, recurved and placed in a broad group with an outer row of larger, conical, and pointed teeth. The vomer is furnished with a small, arrow-headed patch of very minute teeth, and the palate bones with a narrow band of similar teeth. The tongue is broad, and armed with a patch of similar teeth or asperities.

The dorsal fin is long, but not much elevated; it has ten spines, the anterior short, the sixth and seventh longest, and ten branched rays longer than the spines. The pectoral is rather broad; it begins just at the back of the opercle and terminates at the root of the second anal spine, and has fourteen rays. The ventral arises nearly with the pectoral, and ends rather behind the vent; it has one stout spine and five soft rays. The anal arises opposite the root of the ninth dorsal fin and terminates in a rounded extremity with it behind; it has three spines, the anterior short, the others long and stout, and ten branched rays. The caudal is large, broad, slightly notched behind, and has seventeen rays.

The scales are large, quadrilateral, straight and broadest before, rounded and ciliated behind. The lateral line runs parallel with the dorsal arch to the extremity of the dorsal fin, whence it descends to the median plane.

COLOR. See *Specific Characters*.

DIMENSIONS. The distance from the opercle to the tip of the tail is equal to two heads and a half; the greatest elevation without the dorsal fin, is equal to one head and one eighth; total length, ten inches.

GEOGRAPHICAL DISTRIBUTION. St. John's river, Florida.

GENERAL REMARKS. This fish, though it bears a close resemblance to the *Calliurus maculatus* of Rafinesque, may be distinguished from it by the breadth of the bands of its vomerine and palatine teeth; by the larger scales, and by the lesser thickness of its body in front of the dorsal fin. Specimen in the collection of Prof. Agassiz.

#### Genus PIMELODUS, *Cuvier*.

##### PIMELODUS MARMORATUS.

##### *Plate VI. Fig. 4.*

SPECIFIC CHARACTERS. Body dusky above, with a purple tint; sides pale slate color, with dark spots and blotches; belly milky white; dorsal, ventral, and caudal fins with dark spots near their roots; barbels eight. D. 1 - 6. P. 1 - 7. V. 8. A. 22. C. 18.

DESCRIPTION.—The head is large, broad, rather convex above, compressed at the sides, with the snout very full and rounded. The eye is small; it is placed twice its diameter from the snout,  $3\frac{1}{2}$  diameters from the extremity of the opercle, with its lower margins near the median plane of the head. The anterior nostril is tubular, and very near the snout; the posterior is a fissure in the root of the nasal barbel.

The pre-opercle is large, strong, and semicircular. The opercle is long, narrow with its angle somewhat prolonged. The opening of the mouth is very large transversely; the lower jaw and intermaxillary bone are each armed with a semicircular patch of card-like, conical, and pointed teeth, arranged in several series; the tongue is stout, thick, broad and covered with papillæ near the tip and at the sides. The superior pharyngeal bones are covered with numerous pointed, villiform teeth, and a few teeth of rather larger size in front, with recurved points; the inferior pharyngeal has an oblong patch of minute, card-like, pointed, and nearly straight teeth. There are eight barbels, all black and rather slender. The maxillary is long, extending to the middle of the pectoral fin, and is flattened at its root. The nasal is delicate; it extends midway between the snout and the angle of the opercle; there are four mental barbels equidistant from each other, but the two external are one fourth longest.

The dorsal fin is elevated; it arises on a line with the posterior fourth of the pectoral, and has one spine, which is serrated on its anterior margin, and six branched rays; the soft dorsal is rather large, and is placed opposite the posterior half of the anal fin. The pectoral is large; it arises rather in front of the termination of the opercle, and ends with the root of the last dorsal soft ray; it has one spine, somewhat flattened, and serrated at its anterior margin; there are seven soft rays. The ventral is short and placed far back, and extends to the root of the second anal ray; it has eight branched rays. The anal is large, elevated and long, though it ends before the root of the caudal; it has twenty-two rays. The caudal fin is large, broad, and nearly square at its tip, and has eighteen rays.

SPLANCHNOLOGY.—The liver is very large, thick, and entire in front, but terminating in two lobes behind; from each side of the anterior central portion projects a lobule, into the corresponding hypochondrium, which are here represented by cavities lined with peritoneum, and as these cavities are contracted at their orifice, they seem at first view to be exterior to the common cavity of the abdomen. The gall bladder is large, subpyriform, and is concealed by the right lobe of the liver. The stomach is broad before, narrower, but thicker in its walls behind; it extends to about the middle of the abdominal cavity, and is then reflected forward to form the pyloric portion; it has numerous folds of mucous membrane, and the pyloric valve is well marked. The small intestine is twice as long as the animal itself, and has numerous convolutions. The rectum is broader than the small intestine, shorter, and without a fold or valve. The kidneys are large and consist of two portions; one flat, ribbon-like, and

placed along the spine, the other large, triangular, with its base lunate, and partly beneath the air bladder, though the greater portion is behind it. There is no urinary bladder. The air bladder is very large, sub-cordiform, though it is rounded behind, and not very deeply notched before. Its outer wall is thick, firm, shining, silvery; its cavity is not entire, but is partially divided.

COLOR. See *Specific Characters*.

DIMENSIONS. The distance between the angle of the opercle and the tip of the tail is equal to three heads and one eighth; the greatest elevation without the dorsal fin is equal to three fourths of a head; total length nine inches.

GEOGRAPHICAL DISTRIBUTION. Altamaha, Georgia. The original specimen is in the collection of Prof. Agassiz, at Cambridge, Massachusetts.

#### Sub-family ETHEOSTOMATA, *Agassiz*.\*

CHARACTERS.—Head small, but in some elongated, in others rounded or truncated; mouth variable in size; teeth very minute; only one suborbital bone, the anterior; no pseudobranchiæ; no air bladder; scales proportionally large.

REMARKS.—This is a sub-family of Cottoids and includes only small or medium-sized fishes, which are somewhat related to the Gobidæ. It embraces, as it now stands, four genera, *Etheostoma*, *Rafinesque*; *Pileoma* and *Boleosoma*, *De Kay*; and *Pæcilostoma*, *Agassiz*.

#### BOLEOSOMA, *De Kay*.

CHARACTERS.—Head short, compressed, round in section of a circle; mouth small, horizontal, slightly protractile; opercular apparatus covered with scales; opercle with a small spine; branchial rays six.

REMARKS.—Although *De Kay* placed this genus among the Percidæ, yet he was aware that it did not properly belong to that family. As he says, it “contains no genus combining the characters of two dorsal fins and six branchial rays;”† and he further observes that *Boleosoma* approaches in the form of its head, etc., to *Etheostoma*.

#### BOLEOSOMA, *BARRATTI*.

SPECIFIC CHARACTERS.—Head, neck and body compressed; head with greenish tints at the opercle; body above pale brown; belly white; a longitudinal row of subround dusky spots on the sides; second dorsal and anal fins with dusky points arranged in lines.

D. 10 – 11. P. 12. V. 1 – 5. A. 10. C. 14.

\* *Lake Superior, etc.*, p. 298.

† *Nat. Hist. N. Y.*—Part IV., p. 21.

DESCRIPTION.—The body is elongated, slender, compressed, and thicker below than above. The head is small, short, compressed, narrow between the eyes, with the snout rounded and full, though not so broad as the occiput; it is smooth above, though covered with scales on the sides. The eye is very large, and is placed half the diameter of its orbit from the snout, and two diameters from the angle of the opercle, with its inferior margin below the median plane of the head, and its superior at the facial outline. The posterior nostril is very near the eye, at the end of the superciliary ridge. The mouth is small, hardly reaching to the eye; the lower jaw is nearly as long as the upper, though its teeth are received within it when the mouth is shut; both are armed, as well as the vomer and pharyngeal bones, with numerous, minute, closely set, pointed, recurved teeth.

The preopercle is so rounded as to present no angle; the opercle is small, triangular with its base before and its apex behind, and is armed with a slender, delicate spine; the subopercle and interopercle are large.

The anterior dorsal fin begins in a line vertical with the anterior third of the pectoral, extends to the vent, and has ten spines; the posterior is more elevated, and has eleven rays. The pectoral arises a little behind the opercle, and extends to the root of the ninth dorsal spine; it is slender, and has twelve rays. The ventral begins at some distance behind the origin of the pectoral fin, but extends beyond it; it is long, slender, has one delicate spine and five soft rays. The anal begins slightly behind the origin of the posterior dorsal fin, and terminates with it behind; it has ten soft rays. The caudal is long, narrow, rounded behind, and has fourteen rays.

The lateral line runs along the superior fourth of the body to the end of the anterior dorsal fin, whence it gradually descends to the median plane of the tail.

COLOR. See *Specific Characters*.

DIMENSIONS. The length from the opercle to the tip of the tail is equal to four heads; the greatest elevation without the dorsal fin, to three-fourths of a head; total length three inches.

GEOGRAPHICAL DISTRIBUTION. Florida and Georgia.

GENERAL REMARKS. This beautiful little species I have dedicated to Dr. John P. Barratt, of Abbeville District, South Carolina, an excellent Naturalist, who has done much for the advancement of Zoology and Botany.

## EXPLANATION OF PLATES.

## PLATE V.

Fig. 1, *Pomotis elongatus*, and scales.

" 2, " *speciosus*, "

" 3, *Bryllus fasciatus* "

" 4, " *gloriosus* "

## PLATE VI.

Fig. 1, *Collurus Floridanus*.

" 2, *Pomotis marginatus*.

" 3, *Beleosoma Barretti*, with outline of head and teeth.

" 4, *Pimelodus marginatus*, with front outline of head.

ART. VI.—*Researches on the Cryptogamic Flora of the State of Georgia.*

By PROF. JULIEN DEBY.

## NOTICE I.—ON THE ORGANIZATION AND MORPHOLOGY OF CHLAMIDOCOCCUS PLUVIALIS.—Plate VII.

The study of cryptogamic botany has had but few votaries, and may yet be considered as in its infancy. During later years only has the microscope been applied to the examination of these often minute but highly interesting productions, and although some very able men have thrown considerable light on this difficult branch of natural history, much remains yet to be done by future observers.

I have paid considerable attention to this subject while in Europe and during my travels in Central America, and have acquired a certain knowledge of the Fungi and Algæ which emboldens me to furnish to those interested in such subjects, a few notes illustrative of such species as I have observed since my short residence in the United States. Every fact stated I have seen myself, but being here in the “up country,” without the necessary literary help, I may, perhaps, in some cases, be led to describe as new, things already known to the public. I have to beg indulgence in behalf of my isolated position. If any of my observations be thought interesting or instructive I shall be sufficiently rewarded for my labors.

It may be well here to state that the microscope I make use of is a good instrument, (of large size,) of Oberhauser's, in Paris. It was made five years ago, has very clear glasses, and three amplifying powers.

I shall, in this first notice, give a short account of a plant I have before met with in Belgium,\* and which I have lately discovered in this country also, namely, *Chlamidococcus pluvialis*, one of the most interesting of fresh water algæ, although one of the minutest.

I have found *Chlamidococcus* in the counties of Cass and Rabun, in the hollows of rocks exposed to the influence of all the atmospheric changes, and which were liable, during rainy weather, to be filled with water and to dry up completely during seasons of drought.

The *Chlamidococcus pluvialis* is synonymous with the *Hæmatococcus pluvialis* of Flotow, and *Protococcus pluvialis* of Kützing. This genus is very nearly allied to *Chla-*

\* I first discovered it at Bloquement, near Dinant, in the province of Namur, in water from the gutter from the roof of my father's house.



midomonas and to Gleococcus, and, if I mistake not, one of its forms is identical with the *Diselmis viridis*, described by Dujardin in his Natural History of Infusoria, as an animal. Kützing mentions this species in his work entitled "Ueber die Verwandlung der Infusorien in neideren Algenformen (Nordhausen, 1844)," and gives it as an example of the impossibility that exists of separating distinctly the animal from the vegetable kingdoms. Von Flotow (in Nova Acta Acad. Naturæ curiosus, Vol. xx., p. 11, 1844,) has given a long account of it, but his work contains many errors of observation and of induction. Alex. Braun (Betrachtungen über die Erscheinung der Verjüngung in der Natur. Leipzig, 1851,) has, in divers portions of his book, given, in a fragmentary form, by far the most elaborate treatise on Chlamidococcus with which we are acquainted. His observations are most accurate and interesting.\*

I have been happy enough to fill up some gaps in the history of this minute amphibolical plant, and shall give as complete an account of this species of Alga as it is in my power.

Chlamidococcus is found, in dry weather, forming a dirty, brownish or reddish tenacious crust, spread in the small hollows of rocks; it may be scraped off with a knife. If put into water it very soon softens, and we find it to be formed of a number of simple round cells. These cells are all of one kind; their diameter varies from 1-10th to 1-36th of a millimetre, their outer membrane is thick, their contents finely granular, and of a reddish color, nearly opaque. Inside we find from two to six grains of amylo (fecula) whose diameter does not exceed the 1-120th of a millimetre, as a maximum, and which were first recognised as such by Alex. Braun, who says that he has discerned in their centre a speck (nucleolus) which turns reddish by the application of the tincture of iodine, whereas the remainder of the amylo grain takes the characteristic tint of fecula. This would indicate a proteine substance in a thick coating of amylo.

In the middle of the cell, (but very difficult of observation, on account of its opacity) is found a large, delicate cytoblast. Fig. 1.

All the round cells above described are, by the ordinary tests, found to be formed, like nearly all other cells, by two coatings: an exterior one of gelin† and an interior

[\* I regret not having been able to consult Prof. Morren's Physiological Researches on the Belgian Hydrophytes, namely, his fifth memoir on the History of the Genus *Hæmatococcus* of Agardh, not having been able to procure this work.

† Several kinds of cellular membrane are usually confounded under the name of cellulose: I recognise as these principle forms: 1st. The *amyl* cell membrane, which turns blue by the simple application of tincture of iodine. 2nd. The *gelin* cell membrane, which only turns blue by the combined action of sulphuric acid and the tincture of iodine. 3d. The *bassorin* cell membrane, which takes a brown or yellow coloring by the preceding tests. 4th. The *protein* cell membrane, which takes a rich orange tint by the tincture of iodine, but can be distinguished from the bassorin cell membrane by its behaviour when treated with hot nitric acid. The three first of these seem to be identical in chemical composition, having for formula  $C^{12} H^{20} O^{10}$ , or what is the same

one (*Primordialschlauch*) firmly adhering to the inner surface of the exterior one, and which remains visible after the first has become entirely destroyed by a prolonged immersion in sulphuric acid.

The outer membrane will often slip off during the experiment, as seen in fig. 2. Besides the larger grains of amyloids already mentioned a considerable number of very minute ones are seen as small specks adhering to the coating of protoplasm, which constitutes the *primordialschlauch*.

Following with care the successive changes in these reddish cells, we observe, first, that the red color retires from the outer part of the cell, so as to concentrate, as it were, around the central cytoblast, leaving a zone of a paler color around the periphery, as seen in fig. 3. Soon after this a separation of the cell contents takes place, and two new cells (secondary cells) are seen to have been formed in the interior of the parent cell. These are fixed, round, and have a nucleus. Fig. 4. This takes place during the first, second, or third night after the immersion. Very shortly afterwards these two younger cells again divide into two others (tertiary cells), so that one primitive cell now contains four smaller ones. Fig. 5.

The four newly formed tertiary cells are very different from the primary one which produced them; they do not exceed the quarter of the latter one in size; their shape is oval; they are red, with a paler yellow ring, Fig. 6. But the most interesting fact is the existence, at the narrower extremity, of two hyaline, flagelliform appendages, which, by their continual motions, give to the plant a rapid rotatory, slightly undulating, progressive motion through the water, Fig. 7. These processes are analogous or identical with what has been observed in *Ædogonium*, *Vaucheria*, *Volvox*, *Gleococcus*, *Chlamidococcus*, *Botryocystis*, *Gonium*, *Pandorina* and other algæ. Their length exceeds the diameter of the cell that bears them; they are transparent, very slender and only distinctly visible when their motion is stopped. The flagelliform appendages seem to be formed by an exsudation or prolongation of the *primordialschlauch*, through the outer cell-membrane, being to all appearance wanting in the young cells. The *Chlamidococcus* have generally a rotatory motion from right to left, but they occasionally turn in the opposite direction, as I have distinctly noticed.

These ovate flagel-bearing tertiary cells are endowed with motion for a period which

$C^{12} H^{16} O^8 + 2H^2 O$ ; the protein is formed of insoluble  $C^{36} H^{25} N^4 O^{10}+$  from 1 to 8 of S. Besides the above we may admit, 5th, the *gelatin* cell membrane, which takes a lively green color by immersion in strong acids. 6th. The *eugelatin* cell membrane of Kützing, which becomes red by the action of acids and blue by that of alkalies. 7th. The *pollenin* cell membrane, found on pollen grains and many spores. 8th. The *suberin* cell membrane. These two last both contain a certain proportion of nitrogen, and are unaltered by the ordinary tests. And, lastly, 9th. The *lignin* cell membrane which gives the same reactions as the *bassorin* cell membrane, but seems to have a different composition, namely, according to Mulder  $C^{12} H^{16} O^8$ , or according to Gay Lussac and Thenard,  $C^{64} H^{88} O^{39}$ . It appears to be *bassorin*, minus two equivalents of water. The *suberin*, or cork cell membrane, has for formula  $C^{15} H^{12} O^{13} N^4$ .

does not exceed three days, and is dependent on the state of the atmosphere. They gradually grow to four times the primitive size, and as they grow, the narrower extremity lengthens into a kind of beak, or rostrum, which bears the two flagels. This rostrum is always transparent, empty, and is incapable of any kind of motion. Fig. 7.

The whole cell has a pyriform appearance. It has, from the first period of its existence, *secreted* an external transparent delicate membrane, which widens and expands every hour, Fig. 8. This outer covering seems to be of a gelatinous or semifluid amorphous nature (probably gelatinous gelin). As this outer membrane develops itself it gradually encloses the flagelliform appendages, and proportionately slackens their motions, so as at last to stop these altogether, Fig. 9. These cells are the gonidia of some botanists, the macrogonidia of Braun.

By degrees the red matter in these gonidia concentrates around their central nucleus, and the outer paler zone acquires a green color. In this green portion (gelatinous chlorophyll) may be seen, 2, 3, 4, 5, or 6, larger amylon grains, besides smaller specks of the same substance mixed with minute drops of oil, and still minuter particles of globular chlorophyll. Fig. 10.

These cells, if submitted to the ordinary tests, (iodine and sulphuric acid) show that the outer wide membrane is composed of gelin, the quite interior one which is closely applied to the inner surface of the latter being protoplasma (protein substance). The internal green chlorophyll remain unaltered by the tests, but the red portion seems to divide into a number of separate globules, which acquire a deeper and more intense coloring, indicating the presence of protein substance, probably mixed with some oily or waxy compound and some peculiar coloring substance. The coloring matter is soluble in rectified oil of turpentine and in ether, and is, perhaps, a mixture of Erythrophyll and Xanthophyll. These two substances have been proved by Mulder and by Kützing to be formed by the disoxygenation of the chlorophyll under the influence of strong light, of cold, and of other causes. The coloring matter of the *Chlamidococcus* differs from all other red coloring matters in plants (known to me) by its not being turned blue by the action of alkalies.

The chemical structure of the outer coverings of these adult gonidia show that these cells of *Chlamidococcus* differ considerably from the swimming spores of many other algæ, which I believe to be (as asserted by Kützing, *Grundzüge der philosophischen Botanik*, p. 295) in nearly all cases, formed externally by an unprotected protein membrane, which it is easy to distinguish from the bassorin cell membrane of the parenchym cells of many cryptogamia by boiling with nitric acid and adding ammonia.

Each of the first gonidia (cells of the first swimming generation, or cells of tertiary formation) finally becomes stationary, the outer gelin covering hindering all further motions of its flagels. These now disappear, being seemingly re-absorbed into the general coating of protoplasma. The wide outer covering remains unaltered. The

larger amylon grains which, until now, had been distinct, disappear. Fig. 11. Between midnight and morning a longitudinal division of the cell takes place, which divides it into two fixed, immovable cells (cells of quaternary formation.) Fig. 12, *a*. Very shortly after this (one or two hours after) these last formed cells are each in their turn seen to subdivide into two active gonidia furnished with flagelliform appendages. Fig. 12, *b*. These last (cells of quinary formation) move actively even before leaving the envelop of the mother cell, but before dawn finally break through it. They then live the same independent lives that the first swimming gonidia had led, and go on moving actively for two or three days.

This second generation of flagel-bearing gonidia differs from the first only in being green from the onset, each cell having at its birth and ever afterwards a small, red, central mass; whereas, be it remembered, the first generation of active gonidia were red at first, and only acquired a green color some time after their liberation from the mother cell. Figs. 13, 14.

After a period of from 48 to 72 hours (and always during the hours of darkness,) the second generation of motive gonidia each separate into two immovable cells, (6th formation, Fig. 16,) each of which in their turn divide into two new motive gonidia, (gonidia of third generation, 7th cell formation. Fig. 17.) This takes place in exactly the same manner as in the preceding generation, and this multiplication goes on identically and uninterruptedly for a period of about six weeks, producing in that space of time from twelve to nineteen successive generations of motive gonidia.

The latter formed generations often differ somewhat from the first in having the central red spot nearly obsolete or altogether wanting; (fig. 18,) and in some cases as first seen by Von Flotow, in containing large internal hollow spaces, which displace the green lining of gelatinous chlorophyll, giving a lacunose appearance to the cell. Fig. 19. These internal vacuoles sometimes displace the central red mass, and render it parietal, so as to make it resemble an eye, and give to *Chlamidococcus* the appearance of a *Chlamidomonas*. Fig. 20. The green gonidia are very sensible to light, they collect in greater numbers in that part of the vase they are held in, which receives the sun's rays. Their respiration is identical with that of other green plants, i. e., they disengage oxygen during the day and carbonic acid during the night. This fact was noticed by Ehrenberg with respect to *Chlamidomonas*, without his suspecting, however, its vegetable nature, as he describes it as having eggs, an eye and a testicle, which are nothing else than the grains of amylon, the red mass, and the cytotblast we have spoken of above, and which exist as well in *Chlamidomonas* as in *Chlamidococcus*. Each of the gonidia of the 19th or last of the motive generations, gives birth to two immovable green cells, each of which shortly after is in its turn divided into two other cells, but which, differently from what has been taking place in all the preceding generations, are unproductive of a new generation of cells.

These last cells soon take a rounded form, become immovable, attain gradually their full size, absorb their flagelliform appendages, lose their wide outer membrane, cover themselves with a tenaceous and thick cell membrane, turn gradually to yellowish, then to red, or to a brownish-red hue, and now all organic functions seem to lie dormant in them for awhile. Fig. 21.

If these red cells be submitted to the action of iodine and sulphuric acid, they again take a green color. I attribute this to the fact that the gelin coating is turned blue and the protein coating yellow by these tests, the combination of which two colors forms green, but this is only hypothetical.

In some accidental cases the last generations of gonidia, instead of following the above mentioned order of phenomena, divide rapidly into 2, 4, 8, 16, 32 smaller gonidia, which are at first aggregate inside the mother cell which has produced them. (Fig. 22.) They, however, ultimately break loose and swim about freely for some time, without seeming either to grow larger or to produce new cells. These are the Microgonidia of Alex. Braun; they vary from  $\frac{1}{165}$  to  $\frac{1}{94}$  of a millimetre in diameter, have two flagelliform appendages, are of a yellowish or yellowish-green color, and have the rostrum slightly reddish. Fig. 23.

The larger fixed red cells formed by the last (19th) generation of gonidia remain dormant for an indefinite period if left in water. They even seem to die and decompose if left there for a great length of time. But if the water they are contained in be slowly evaporated to dryness in the sun, be it only for a few hours, and fresh water be poured over them, new life is soon manifested, and generally by the next morning fresh gonidia (of primary generation) will be found fully developed and swimming actively about. These will go through the whole series of vegetative phenomena we have above described, and prepare a future generation of fixed cells, destined in their turn to perpetuate indefinitely the existence of this species of plant.

If, instead of immersing the immovable, dormant red cells in water, we simply keep them in a state of dampness for some hours, they will generally divide into two fixed cells (of secondary formation), these in turn will divide into four (of tertiary formation and corresponding with the first generation of appendiculated gonidia) fixed, globular, unappendaged cells; then again into two (quaternary), then, last, into two (quinary) others, and so on for a considerable period of time, which I have not followed out, but which is, most likely dependant upon temperature and the quantity of water furnished. These cells rarely attain above half the size of the primitive mother cell, they are generally globular, of a reddish-brown color, and always destitute of flagelliform appendages.

In the same way that the last swimming gonidia return to the form and nature of the parent cell—so do the last generations of this abnormal form of *Chlamidococcus* also produce larger cells of a thicker and darker color, which cannot be distinguished

from the primitive mother cell, and which, after desiccation, are also capable of reproducing all the above described series of phenomena; on which account they must be considered as identical in functions and nature.

In the last named form of *Chlamidococcus*, in which none of the cells are motive, the wide, outer membrane, which in the normal type envelopes each gonidia, is also secreted, but the divers cells being very close to one another, the consequence is that this gelatinous matter finally forms an apparently continuous amorphous crust of a pale yellowish color, in which the successive generations of cells are immersed. *Chlamidococcus* is now indistinguishable, by a cursory examination, from the genus *Pleurococcus*, Fig. 24. Braun, who has noticed these two modes of growth, noticed also that in the last described form, the production of 4, 8, 16, 32, &c., microgonidia took place occasionally just as described in the more perfect form of *Chlamidococcus*, but these microgonidia are globular and unappendaged, Fig. 29. I believe that in both cases the production of microgonidia must be attributed to quite accidental causes, such as a diseased state of the producing cell, a peculiar tenacity of its outer membranes, or an over-excited formative power brought on by unknown causes. If this were not the case these microgonidia would not die away without producing further generations or acquiring the ultimate dimensions of macrogonidia, which they are never known to do.

#### CONCLUSIONS.

The curious vegetation of *Chlamidococcus* above described may be understood in two different ways:

1. We may imagine every cell, (be it primitive mother cell or motive gonidia) as a spore, or complete individual plant, and admit that as in the lower classes of animals we have here "alternations of generations." By changing the word *animal* into the word *plant*, Steenstrup's description of this singular fact would read as follows:

"Alternation of generations, or the remarkable phenomenon of a *plant* producing offspring, which at no time resembles its parent, but which, on the other hand, brings forth a progeny, which returns in its form and nature to the parent, so that the maternal *plant* does not meet with its resemblance in its own brood, but in the descendants of the second, third, fourth or ( . . . nth) degree of generation; and this always takes place in the different *plants* which exhibit the phenomenon, in a determinate generation, or with the intervention of a determinate number of generations, &c." (See J. J. Steenstrup, *Altern. of Gener.*, translated by George Busk, 1845, Ray Society.)

Now, in *Chlamidococcus*, we may suppose we have a primitive *plant* (first red, fixed cell) *producing an offspring* (motive gonidia) *which at no time resembles the parent, but brings forth a progeny which returns* (after several generations) *in its form and nature, to the parent cell, so that the maternal Chlamidococcus does not meet its resemblance in*



*its own brood, but in its descendants of the 14th or 15th compound generation.* We might carry on this comparison much further, but as we believe it to be a simple *analogy* with the facts stated by Steenstrup as existing in the Medusæ, Polypes, Corallines, &c., and no *identity*, we prefer not prolonging here what we consider to be useless and sterile discussion, and we shall at once pass to the second manner of investigating the matter, which seems more consistent with philosophical induction as applied to Algology.

2. All plants are produced by the multiplication of a simple cell, which in the cryptogamia is called a spore. If we follow out the subsequent development of such a spore, we observe it generally to produce a succession of vegetative cells (not spores), until having at last attained maturity, (having produced a determined number of such cells) it forms one or several peculiar cells of a different nature from the antecedent one. These last are the real spores destined to produce a new succession of vegetative cells, and after these a second generation of spores. The cells formed anteriorly to the spores are generally connected together by cohesive or intercellular substance, so as to form a parenchymatous mass, or thallus. The formation and deposition of cells may take place according to three dimensions of space. It may take place in length (in a linear direction), and we have a filamentous (articulated) thallus, as in *Conferva*, *Zygnema*, &c. It may take place in length and in breadth simultaneously, and we have a foliaceous thallus, as in the *Ulvacæ*, &c.; or, lastly, it may take place in length, breadth, and height (thickness) at the same time, and we obtain a massive parenchymatous thallus, which may be regular or irregular.

In the development of *Chlamidococcus* in a damp place, or when kept humid, as above described, we have an exemplification of an alga produced by an ordinary spore, and consisting in an irregular foliaceous thallus, which, after growing for a determined time (by production of new vegetative cells) dies away, all but the last formed spores, which remain dormant until called into life by external circumstances. May we not consider also the development of the *Chlamidococcus*, immersed in water, as a growing plant, in which the ordinary vegetative cells are free (instead of being united into a so-called compact thallus) and in which the terminal or last formed cells, just as in other algæ, end by giving birth to spores? I think analogy and morphological considerations lead to the adoption of this manner of viewing the subject. In fixed algæ the cells are immovable, and united to one another in the thallus; in the form under consideration they differ only in being free and being furnished with prolongations of the inner cell membrane, which give them for a short period limited locomotive powers. In the crustaceous form of *Chlamidococcus*, where these flagelliform organs would be useless, we find them to be wanting, and yet the plant is fertile that is, bears at last well-formed spores at the surface of its thallus, so that we may consider these curious appendages of very secondary importance in the organic

economy of this plant. According to the above expressed views I would define *Chlamidococcus* as *a plant formed by a successively deliquescent and evanescent thallus, each vegetative cell of which is free, is endowed with an independent motion* (produced by two lengthened flagelliform appendages) *and has an independent life*. Each new generation of four cells being accompanied by the destruction of the precedingly formed part of the thallus which has produced it. *The terminal (or last formed) cells of this vague thallus produce globular, fixed, unappendaged red spores*. These spores contain from two to six large grains of amylon and a central cytoblast. The fully developed evanescent *parenchym?* cells of the *thallus?* are green, with a red central (not parietal) mass, in the middle of which is situated the cell nucleus.

In an aberrant form this alga constitutes a continuous, non-evanescent thallus, in which the cells are globular, unappendiculated, and united by an amorphous intercellular substance. This discoid thallus produces at its periphery (surface), spores identical with those generated by the typical form.

I believe the above definition to be consistent with the strictest laws of analogy, as applied to the morphology of the lower plants; if I have erred, I shall be sufficiently rewarded for my labors if I should have attracted the attention of other naturalists, and induced them to take up the study of this interesting branch of natural history.

Linnæus has said, "Nullus character infallibilis est;" but however little encouraging this maxim may seem, it must not dishearten nature's votary, who can only describe things to the best of his abilities, in a way concordant with the present state of science, and who must ever remember that perfection is the attribute of the Creator, not of the creature, and that human *science* is only a very small, fragmentary, shapeless particle of Omniscience, which last is beyond his reach.



ART. VII.—*Descriptions of New Species of Birds of the Genus SPERMESTES, Swainson, in the Museum of the Academy of Natural Sciences of Philadelphia.*

By JOHN CASSIN.

1. SPERMESTES NIGRICEPS. Cassin. Proc. Acad. Philada., VI., p. 185 (1852). Plate VIII., fig. 1, male; 2, female.

*Form.*—Small, bill large and strong, wing with the second primary slightly longest, tail short, but wide, and with the feathers broad.

*Dimensions.*—Total length (of skin) about  $3\frac{1}{4}$  inches, wing  $1\frac{3}{4}$ , tail  $1\frac{1}{2}$  inches.

*Colors.*—Male: head black, which color is extended to the breast and sides of the body; on the last (the sides) the black feathers are tipped with white. Middle of the abdomen and under coverts of the tail white. Back and wing coverts bright reddish chesnut, primaries black with minute spots of white on their outer webs, exposed portions of secondaries reddish chesnut, rump black with minute white spots, tail black. Bill and feet (in skin) light colored.

Female: entire plumage above brown, tinged with chesnut on the back, below pale brownish white, with a tinge of yellow, and with a few traces of black on the throat, primaries black edged with white, tail brownish black.

*Hab.*—Zanzibar.

*Obs.*—Of this handsome little species three specimens are in the museum of the Academy, and belonged to the Rivoli collection. All of them are marked as from Zanzibar. It is not in any considerable degree similar to any other species of this genus with which I am acquainted, but is spotted with white on the wings like *Spermestes poensis*. Fraser.

2. SPERMESTES FUSCANS, Cassin, Proc. Acad. Philada., VI., p. 185 (1852). Plate VIII. fig. 3. Adult male?

*Form.*—Small, robust, bill very strong, wing with the first, second and third quills very nearly equal, tail rather long, with the middle feathers longest.

*Dimensions.*—Total length (of skin) about  $3\frac{1}{4}$  inches, wing 2, tail 2 inches.

*Colors.*—Entire plumage dark chocolate brown, darker on the throat and around the base of the bill, inner webs of quills paler and nearly white. Bill, horn color.

*Hab.*—Borneo.

*Obs.*—Though several specimens of this bird in the museum of the Academy have been labelled in Europe "*F. nigerrima*," and "*F. aterrima*", I have not succeeded in finding it described. It does not intimately resemble any other within my knowledge, and may be easily recognized by its plain and uniform plumage. All the specimens are labelled as natives of Borneo.

ART. VIII.—*Notice of Fossils from the Carboniferous Series of the Western States, belonging to the genera SPIRIFER, BELLEROPHON, PLEUROTOMARIA, MACROCHEILUS, NATICA, and LOXONEMA, with descriptions of eight new characteristic species.* By JOSEPH G. NORWOOD and HENRY PRATTEN, of the Illinois Geological Survey.

### SPIRIFER.

*S. SPINOSUS, nob.*—Plate IX. fig. 1, *a, b, c, d.*

Shell rather small. Both valves very convex. The dorsal valve bears five or six rounded ribs on each side of the sinus. The ventral valve has four, and sometimes five, similar ribs on each side the central lobe. The lobe itself resembles a large rib, being only about double the size of those next to it on each side. The other ribs gradually diminish in size as they approach the cardinal border. They are covered with large and deep but irregular striæ of growth, which are most numerous near the margin. Besides these large imbricated striæ some of the most perfect specimens are beautifully marked with finer concentric striæ, visible only by the aid of a lens. The surface of the shell is irregularly covered with short, hollow spines, projecting at nearly right angles from their bases. On all the specimens yet met with the spines are broken, the longest fragments measuring about one-sixteenth of an inch. In addition to these spines, the whole shell, including the cardinal area, is covered with minute granules. Where these are rubbed off there is the appearance of small openings into the shell, giving it the aspect, somewhat, of being covered with a minute coral. Cardinal area, triangular; high; a little shorter than the greatest breadth of the shell, and having sharp edges on the ventral valve only. The median slit is large and open, and occupies about one third of the space left free from the encroachment of the ribs of the dorsal valve.

*Dimensions.*—Length, six tenths of an inch; breadth, eight tenths.

*Comparisons and Differences.*—This shell has nearly the form of the *S. octoplicatus*, of Sowerby, but differs in having fewer ribs; in the sinus of the dorsal valve being wide and rounded at its bottom; and also in all its ribs being rounded. When the epidermis is well preserved, the spines with which it is covered will readily distinguish it from all other species.

*Geological Position and Localities.*—This species occurs near the top of the mountain limestone, associated with *Pentremites sulcatus*, *pyriformis*, and *florealis*, *Productus*



*elegans*, and *Spirifer Fisherianus*. It is very abundant at Chester, Illinois. It is also found in Pope county; and in Missouri, opposite Hat Island.

*Explanation of the Figures.*—Pl. IX. fig. 1, *a*. A specimen, showing the dorsal valve.  
*b*. The same, showing the ventral valve.  
*c*. Front view of the same.  
*d*. Magnified view of a portion of the same, showing the spines and tubercles.  
 Illinois State Collection.

*S. LEIDYI, nob.*—Plate IX. fig. 2, *a, b, c*.

Shell of medium size; extremely variable in form, some specimens being globose, while others are rather flattened. In young specimens the cardinal border is equal to the greatest breadth of the shell; in old ones the greatest breadth is towards the middle. The dorsal valve is furnished with a sinus, having sharp borders. It reaches to the beak, and opens under an angle of  $16^{\circ}$ . There is one tolerably large rib at the bottom of the sinus, and on each side of it we find another, which is rather flattened, and placed like a step about midway from the middle rib to the top of rib bordering the sinus. On either side of this the ribs number from six to eight. Sometimes there are six or eight on one side and seven on the other. The varix of the ventral valve is strongly projected above the rest of the shell, although its height is diminished by a furrow which corresponds to the rib found at the bottom of the sinus of the other valve. On the sides of the varix there are step-like projections, similar to those found on the sides of the sinus. On a few specimens, however, these ribs are wanting on one side, but are never altogether absent. On each side of the varix there are from six to eight rounded ribs, similar to those on the dorsal valve. The ribs on both valves project strongly. Some of the specimens are beautifully marked, especially toward the front margin of the shell, by imbricating lines of increment. These are disposed in such a manner as to show that the shell increased faster in length than it did in breadth. Other individuals are entirely destitute of these markings. On all well preserved specimens the surface is covered with fine striæ, only to be discovered under the lens.

Some of these striæ are parallel to the ribs, and others to the free borders of the shell, so that they cross each other, forming a kind of net-work. Those radiating from the beak are rather more prominent than the others. The cardinal area is of moderate height and triangular, the angle being  $152^{\circ}$ . It is covered with perpendicular and transverse striæ. Deltoid aperture open, and of medium size.

*Dimensions.*—Length, eight tenths of an inch; breadth, one inch.

*Comparisons and Differences.*—This species comes nearest to the *S. acuticostatus* of De Koninck, but differs in its ribs, which are rounded, while those of the *acuticostatus* are sharp. The supplementary ribs on the sinus and varix will, however, at once distinguish it from that species. It is also a larger shell.

*Geological Position and Localities.*—This fossil is common at Chester, Illinois, in the upper part of the Mountain Limestone, where it is associated with the *S. spinosus*. Although frequently met with at that locality, well preserved specimens are very rare.

*Explanation of the Figures.*—Pl. IX. fig. 2, *a*. View of the dorsal valve of an adult individual.

*b*. The same, showing the ventral valve.

*c*. Front view of the same.

Illinois State Collection.

Dedicated to Prof. Joseph Leidy, of Philadelphia.

*S. FORBESII, nob.*—Plate IX. fig. 3, *a, b, c*.

Shell of medium size; its greatest breadth being along the cardinal line. Dorsal valve rather more gibbous than the ventral, and furnished with a very shallow sinus, hardly amounting to a depression, but which is well defined by a large rib on each side. The sinus is formed of five ribs, the central one being large, with a smaller one on each side, which last spring, a short distance below the beak, from the large ones, which limit the sinus. On either side of the sinus there are from sixteen to twenty-two simple ribs, marked by undulating lines of growth. On the ventral valve the varix is not raised, but is limited by two furrows, wider and deeper than any others on the valve, except the central one of the varix, which corresponds to the large rib in the centre of the sinus of the opposite valve. The varix is formed by two ribs, which originate at the beak and bifurcate after proceeding a short distance, so that it is made up of two pairs of ribs, divided by the large central furrow. The remainder of the ribs on this valve are like those on the opposite one. Cardinal area unknown.

*Dimensions.*—Length, nine tenths of an inch; breadth, two inches.

*Comparisons and Differences.*—This species differs from the *S. attenuatus* of Sowerby, which it most nearly resembles, in having fewer ribs on the sinus, and a much less number on the whole extent of the shell; and also in the ribs being simple, while in the *attenuatus* they are dichotomous. It cannot be confounded with any other species known to us.

*Geological Position and Locality.*—It occurs in the middle of the Mountain Limestone series, at Burlington, Iowa. We have not been able, so far, to obtain specimens from any other locality, nor have we found the two valves united. It is rare.

*Explanation of the Figures.*—Pl. IX. fig. 3, *a*. View of the dorsal valve.

*b*. View of the ventral valve of another individual.

*c*. View of the beak and hinge line of the dorsal valve.

Illinois State Collection.

## BELLEROPHON.

*B. PERCARINATUS*, *Conrad*. Plate IX. fig. 4, *a*, *b*, *c*.

This very beautiful shell, which was figured and described by Mr. Conrad in 1842, in the Journal of the Academy of Natural Sciences, old series, is figured here on account of its position in the coal measures of the west, as well as the greater size to which it attains in western localities.

*Geological Position and Localities*.—Found at Graysville, Illinois, and in Posey county, Indiana, five miles below New Harmony, in clay shales belonging to the coal measures.

*Explanation of the Figures*.—Pl. IX. fig. 4, *a*. Specimen of the natural size. View of the back.

Fig. 4, *b*. View of the mouth of the same.

Fig. 4, *c*. The same, seen in profile.

Illinois State Collection.

*B. MONTFORTIANUS*, *nob.*—Plate IX. fig. 4, *a*, *b*, *c*.

This species belongs to the same section as the *B. Urvii* of Fleming, being sulcated and not umbilicated. It is rather small, with the exception of the last whorl, the mouth part of which is enormously expanded, both in length and breadth. The shell is crossed from side to side by a series of large, wavy ridges, which are cut through in their centre by a deep longitudinal furrow. The ridges and furrow become obsolete on the expansion of the mouth. The entire surface is covered with fine longitudinal ribs, so numerous that it is almost impossible to number them. The mouth is, apparently, without a notch; exterior lip semicircular; inner lip very much thickened, and, with the central parts, projects so far forwards as to form with the sides of the shell two semicircles.

*Geological Position and Localities*.—This is another most beautiful species belonging to the coal measures, and is found associated with the *B. percarinatus* and *B. Urvii* at Galatia, Illinois, and five miles from New Harmony, Indiana.

On account of the extreme thinness and great expansion of the mouth, no entire specimen has been met with. The dotted outline has been given from an internal mould of the mouth which we were so fortunate as to obtain.

*Explanation of the Figures*.—Pl. IX. fig. 5, *a*. View of the back of an adult individual.

Fig. 5, *b*. View of the mouth of the same.

Fig. 5, *c*. The same, seen in profile.

Illinois State Collection.

Named in honor of the founder of the genus.

B. URIL, *Fleming*.—Pl. IX. fig. 6, *a*, *b*, *c*.

This figure is given on account of possessing a perfect mouth, which none of those figured by De Koninck and Phillips have.

*Geological Position and Localities*.—This species is very abundant in the coal measures, at Galatia and Grayville, Illinois, and on the Wabash, five miles below New Harmony, Indiana.

*Explanation of the Figures*.—Pl. IX. fig. 6, *a*. View of the back.

Fig. 6, *b*. View of the mouth of the same.

Fig. 6, *c*. The same seen in profile.

Illinois State Collection.

### PLEUROTOMARIA.

P. GRAYVILLENSIS, *nob.*—Pl. IX. fig. 7, *a*, *b*.

Shell small, being about half an inch in breadth and the same in length. Whorls five, flattened above; the body whorl rounded below. Spiral angle  $102^{\circ}$ . Shell covered with longitudinal lines, crossed by lines of growth, giving it the appearance of being garnished with small tubercles. The upper line of tubercles on each whorl, near the suture, is much more prominent than the others, forming a raised ornamental band. The band of the sinus is large, and separated from the inferior part by a furrow. Mouth sub-quadrangular; exterior lip sharp; columella lip thickened, the columella terminating below in a point.

*Geological Position and Localities*.—This species occurs in the coal measures, and is quite common in the shales near the mouth of Rush creek, Posey county, Indiana, and Grayville, Illinois. It is also found near Shawneetown, and in the neighborhood of Galatia, Saline county, Illinois.

*Explanation of the Figures*.—Pl. IX. fig. 7, *a*. A specimen of the ordinary size, exhibiting a front view.

Fig. 7, *b*. The opposite side of the same.

Illinois State Collection.

P. CARBONARIA, *nob.*—Pl. IX. fig. 8.

Shell of medium size. Length, 1 inch; breadth, 1 1-20th inch. Whorls five, rounded, covered with strongly raised, sharp, longitudinal ribs, the grooves or furrows between which are rounded, and much broader than the ribs themselves. The sinus consists merely of a broader groove, in which there are two or three raised ribs similar to those on the remainder of the shell, but much smaller. On the inferior half of each whorl, below the sinus, both the ribs and furrows are much smaller than those on the upper portion. Mouth nearly semicircular; lip sharp.

*Geological Position and Locality.*—This species appears to be very rare, having been found only at Rock Creek, Williamson county, Illinois, where it occurs in a black, carbonaceous shale, belonging to the coal measures.

*Explanation of the Figure.*—Pl. IX. fig. 8. View of the front and left side of an adult specimen.

Illinois State Collection.

#### MACROCHEILUS.

*M. INHABILIS*, *Morton*, sp. Pl. IX. fig. 9, *a*, *b*.

*FUSUS* (?) *INHABILIS*, *Morton*.—"American Journal of Science and Art," 1st Series, Vol. xxix., p. 150, fig. 14, plate 3.

This species, which was found in 1834, by Dr. S. P. HILDRETH, of Marietta, Ohio, occupying the same position it does further west, was referred by Dr. S. G. MORTON to the genus "*Fusus*?" and published without any adequate description. Its occurrence in the same geological horizon over so large a district of country, gives it an importance which renders it desirable to supply the deficiency.

Shell nearly globular; spire short, forming an angle of 105°. Whorls five; the body whorl very large and inflated, while the remainder are comparatively small, and occupy only one seventh of the total length of the shell. Aperture semi-elliptical; much longer than wide. Columella rather long, and furnished with a distinct fold. The length of a large specimen is 1 8-10th inches. This species resembles somewhat the *M. Michotianus* of De Koninck, but differs from it in its greater size, and in having but five whorls; that species having six.

*Geological Position and Locality.*—This species is found in the middle of the coal measures at Grayville and Galatia, Illinois, and rather more abundantly, but of smaller size, in the shales of the same formation in Posey county, Indiana. It also occurs, according to Dr. HILDRETH in the same part of the coal series of Ohio.

Illinois State Collection.

*Explanation of the Figures.*—Pl. IX. fig. 9, *a*. Front view of a large individual.

Fig. 9, *b*.—Back view of the same.

#### NATICA.

*N. VENTRICA*, *nob.*—Pl. IX. fig. 10, *a*, *b*.

Shell small, globose, ventricose; spire very short, consisting of four whorls, the body whorl being very large, and occupying six sevenths of the whole length of the shell. The upper portion of each whorl is ornamented by a series of lines radiating from the axis of the shell, which proceed outwards from the suture and then slightly

backwards. The remainder of the surface is smooth. The aperture is nearly semi-circular. Length, seven tenths of an inch; breadth, nearly the same.

*Geological Position and Locality.*—This species was found by Major T. C. Downey, in the coal measures, one mile south of New Harmony, Indiana, the only locality in which it has yet been discovered.

*Explanation of the Figures.*—Pl. IX. fig. 10, *a*. Front view, showing the aperture. Fig. 10, *b*. Back view of the same.

Illinois State Collection.

### LOXONEMA.

L. HALLII, *nob.*—Pl. IX. fig. 11, *a*, *b*.

Shell of medium size; elongated. Length, one inch and eight-tenths; breadth, six tenths of an inch. Opening of the spiral angle  $22^{\circ}$ . Whorls ten, flattened, or only swelling out at the upper part, producing a deep suture between them; they are covered with slightly raised transverse ridges. Mouth long and narrow, three times as long as broad, and terminating below in a shallow groove or notch, not prominently marked except in well-preserved specimens.

*Geological Position and Localities.*—This species has only been found in the coal measures. It is very abundant on the Wabash, five miles below New Harmony, Indiana, in the clay shales of that formation. It also occurs at Galatia, Saline county, Illinois, in equivalent beds.

*Explanation of the Figures.*—Pl. IX. fig. 11, *a*. Front view of a large specimen.

Fig. 11, *b*. Back view of the same.

Illinois State Collection.

We take great pleasure in dedicating this new species to the eminent American palæontologist, Prof. James Hall, of Albany, New York.

*New Harmony, Indiana, January 23d, 1855.*



1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

$$\frac{dx}{dt} = f(x, y), \quad \frac{dy}{dt} = g(x, y),$$

where  $f$  and  $g$  are continuous functions of  $x$  and  $y$  in a region  $R$  of the  $xy$ -plane. It is shown that if  $f$  and  $g$  are continuous in  $R$  and if  $f$  is bounded in  $R$ , then there exists a solution of the system of equations in  $R$ .

2. The second part of the paper is devoted to a discussion of the problem of the uniqueness of solutions of the system of equations

where  $f$  and  $g$  are continuous functions of  $x$  and  $y$  in a region  $R$  of the  $xy$ -plane. It is shown that if  $f$  and  $g$  are continuous in  $R$  and if  $f$  is bounded in  $R$ , then there exists a unique solution of the system of equations in  $R$ .

ART. IX.—*Plantæ Prattenianæ Californicæ: An enumeration of a collection of California Plants, made in the vicinity of Nevada, by Henry Pratten, Esq., of New Harmony; with critical notices and descriptions of such of them as are new, or yet unpublished in America.*

By ELIAS DURAND.

This collection, which was placed in my hands by the Philadelphia Academy of Natural Sciences in the latter part of last year, is composed of about two hundred specimens, many of which, unfortunately, are in a very incomplete state. It was made during the spring and summer of 1851, in the vicinity of Nevada, a place situated on Deer Creek, one of the affluents of the Sacramento river, and occupying an intermediate position between the mountains of the Sacramento and those of Calaveras county. Nevada stands at an elevation of about three thousand feet above the level of the Pacific Ocean, near the junction of the granitic and schistose rocks. To the soil of the former, as well as to that of the porphyritic lavas, are confined the large pines, firs and arbor-vitæ, while the nut pines and acacias thrive only on the schistose rocks. I am informed by Mr. Pratten that many of his plants belong, exclusively, either to the granitic or to the schistose formations, whilst others grow indifferently on both.

Before entering upon a serious investigation of these specimens, I put aside all those that were new to me, with the view of submitting them to my friends, Profs. Torrey and Gray, who have had under examination several large collections of California plants. To the great experience and friendly assistance of these learned botanists I am highly indebted. They have been good enough to point out the species which they had already described in manuscript, and to procure for me Bentham's *Plantæ Hartwegianæ*, or descriptions of new plants collected by Hartweg in the mountains of the Sacramento river—a publication extremely rare in this country, and in which I found descriptions of many of the plants I had before me.

All the new species of Mr. Pratten's collection, described either by Profs. Torrey, Gray, Mr. Bentham, or by myself, amounting together to about forty, have been united in this essay, and may be considered as new matter, not having been published as yet in any American work. Whenever I have failed to obtain Professors Torrey and Gray's notes, (their manuscript being in the hands of the printer,) I have endeavored to supply this want by giving my own diagnosis.

## RANUNCULACEÆ.

AQUILEGIA FORMOSA, Fisch. in Torr. and Gr. Fl. Am. vol. i. p. 30. The whole plant stouter and with larger flowers than *A. canadensis*; leaves more remote, somewhat fleshy and on short petioles; styles scarcely equalling the stamens; otherwise, hardly more than a variety of *A. canadensis*. On rocks bordering Deer Creek. June.

DELPHINIUM MENZIESII, D. C. in suppl. to Torr. and Gr. Fl. Am. vol. i. p. 661. Flowers large, deep blue, raceme 8–10 flowered. April.

D. SIMPLEX, Dougl. in Hook. Fl. Bor. Am. vol. i. p. 25.

D. DECORUM, Fisch. and Meyer, in Torr. and Gr. Fl. Am. suppl. vol. i. p. 661.

D. BICOLOR, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 33.

## BERBERIDACEÆ.

BERBERIS AQUIFOLIUM, Pursh.—Var. *a*, in Torr. and Gr. Fl. Am. p. 50. On granitic hills.

## PAPAVERACEÆ.

CHRYSEIS CALIFORNICA, Hook and Arn. in Torr. and Gr. Fl. Am. vol. i. p. 63, and suppl. p. 664.

## FUMARIACEÆ.

DIELYTRA FORMOSA, D. C. *D. saccata*, Nutt. *Fumaria formosa*, Dryand. in Torr. and Gr. Fl. Am. vol. i. p. 67, and suppl. p. 665. Shady granitic hills. April and May.

## CRUCIFERÆ.

CARDAMINE PAUCISECTA, Benth. pl. Hartw. p. 297. Spec. Nov. “Hirtella vel glabriuscula, foliorum radicalium segmentis 1–5, longe petiolatis, ovato-orbicularibus vel subreniformibus obtusissimis; caulinarium 3, oblongis, basi angustatis, sessilibus.

Smaller than *C. pratensis*, but same habit and inflorescence. Radical leaves long-petiolate, sometimes entire, limb 12.15'' broad, truncate at base, margin obscurely sinuate; but oftener, above the middle of the petiole, with 2, or more seldom, 3–4 lateral segments, similar to the terminal one, only smaller and long petiolulate. Cauline leaves few and small, generally 3-partite, with narrow segments much smaller than the terminal one.”\*

\* I have specimens of a cardamine, collected by Dr. Heermann on the bars of the river Calaveras, which I consider as a form of *C. paucisecta*, although somewhat differing from Hartweg and Pratten’s plant. As is frequently the case with California specimens, the radical leaves are wanting; but towards the middle of the stem the first cauline leaves begin to appear. These are 5–7 pinnately divided, and answering pretty well to

ERYSIMUM ARKANSANUM, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 95. With orange colored flowers. In my opinion *E. asperum*, D.C., *Arkansanum* and *elatum*, Nutt., might be considered as different forms of one species. *E. asperum* is somewhat canescent, but they are all more or less scabrous, with appressed medio-fixed hairs; the lower leaves are runcinate-dentate, those of the stem dentate or entire; the flowers are large, varying from light yellow to orange, the petals have very long claws and obovate limbs; style short and thick, with a bilobed stigma. *E. elatum* (Nuttall's specimen) is a lank and elongated form about 3 feet high. Hilly sides of Deer Creek. August.

## POLYGALACEÆ.

POLYGALA CUCULLATA, Benth., Pl. Hartw. p. 299. "Diffusa, puberula, foliis ovalibus vel oblongo-ellipticis, obtusis retusisve; racemis brevibus plurifloris, sepalo infimo basi gibbo, alis oblongis, carinâ imberbi apice in cucullum oblongum productâ.

Stems branching, prostrate, the lowest part perennial and almost woody; branches herbaceous, slender, 4—6" high, pubescent; leaves with very short petioles, the lowest small ovate, the upper 6—8" long, rounded at tip or often emarginate, cuneate at base, with margins slightly recurved, green on both sides and not punctate, puberulent above, almost glabrous underneath. Flower (rose colored?) 4" long. The exterior sepal concave at base, saccate, oblong; the two superior a little smaller and one-half narrower. They are all membranaceous and colored, the two lateral (wings) twice longer and more slender, obliquely subovate-oblong, equalling the wings of the corolla, and a little shorter than the keel. Lateral petals, or wings, lanceolate and slightly adhering to the base of the keel. Keel split in front, dilated above the base and contracted towards the middle, then abruptly dilated, subrhomboid and terminating in an erect obovate-oblong and obtuse hood. The stamens do not reach the base of the hood; the filaments are fixed to the keel as far as the rent, where they become free. The style is flexuose, tubular, dilated at top and truncate, the stigma resting on the margin. Ovary stipitate, capsule sessile, orbicular, emarginate. There are also, at the base of the leafy branches, short fructiferous branchlets, bearing capsules rather smaller than those of the upper branches, and perhaps produced by apetalous flowers."

The few small specimens I find in Mr. Pratten's collection differ only from the above description in having the hood conspicuously mucronate; but Dr. Torrey informs me that, in the specimens of Col. Fremont, some have the mucro, whilst others have it not.

Bentham's description of the radical leaves of *C. paucisecta*. The upper leaves are ternate, and the leaflets of all the leaves are rhombic-ovate, petiolulate and repand-dentate; each axil is furnished with a few-flowered stipitate raceme, provided with a leaf-like 3-parted or dentate bract. The terminal raceme is 12—15 flowered; the sepals are ovate, with a whitish margin,  $\frac{1}{3}$  the length of the petals, which are white slightly tinged with pink. The root appears to be tuberous, and the stem and petioles are succulent.

## VIOLACEÆ.

*VIOLA BECKWITHII*, Torr.'s MSS. for Beckwith's report, "subcaulescens, adscendens, caule abbreviato; foliis caulinaribus biternatis vel palmatis-sectis, decurrentibus, lobis vel segmentis oblonge-linearibus, hirsutis, pubescentibus; stipulis minutis, scariosis, integris; sepalis linearibus obtusis, ciliolatis, petalo infimo ad basim remisse saccato, purpureo, ad unguiculum luteo, 2 superioribus brevioribus dense violaceis."

Pratten's plant, although evidently the same as *V. Beckwithii*, differs slightly from the above description. It has but a few pentagonal reniform leaves on long margined petioles; these leaves are 3-divided, or pedately parted with cuneiform 2—3 cleft elliptico-linear segments; stipules small, membranaceous, fimbriate; two very minute bracts about the middle of the peduncle; flowers rather small, on peduncles shorter than the petioles; sepals linear-lanceolate, spur scarcely any; stigma orbicular oblique, fringed with short hairs. In shady and marshy woods. April.

*VIOLA LOBATA*, Benth. Pl. Hartw. p. 298. "Glabra, caulibus adscendentibus; stipulis late ovatis, dentatis; foliis latis ovatis subreniformibusve, regulariter palmatis 3—7 lobis. Sepalis lanceolatis acutis, corollæ calcare brevi sacciforme."

"Rhizoma short, ascending. Stems half a foot high. Inferior stipules two lines wide and auriculate at the base, the superior ones narrower acute. The lower leaves are more wide than long, on long petioles, with lobes ovate or oblong, obtuse or acute, and mostly divided above the middle of the lamina; the upper leaves are generally trifid, with the middle lobe larger than the others, on peduncles about two inches long, provided, above the middle, with two small approximate or distant bracteoles. Flowers yellow? petals beardless. The appendices of the anthers very unequal; the superior a little shorter than the anther itself, the inferior very short. Style clavate, incurved, with an oblique stigma, and ciliate with retrorse hairs under the stigmatose part."

In my specimens the stems are striate, branching, eight inches long. The leaves are strongly veined, the inferior glabrous, cordate, palmately divided from about the middle, with lanceolate lobes; the upper are pubescent-scabrous, ovate-rhomboid, with lateral dentiform lobes. The stipules are foliaceous, broadly-oblong, mucronate-dentate, or entire and lobed, attaining towards the middle of the stem twice the length of the petioles. The flowers are numerous, on rather short peduncles, each having two small bracts, distant or approximate, above the middle. Petals apparently *bluish* in my specimens, obovate, twice the length of the sepals; lateral ones somewhat bearded at the claw; spur wide and saccate; style incurved, ciliate with retrorse hairs under the oblique stigma. Capsule ovate. Shady woods. May.

*V. PRÆMORSA*, Dougl. in Torr. and Gr. Fl. Am. vol. i. p. 141.

*V. LONGIPES*, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 140.

## HYPERICACEÆ.

HYPERICUM SCOULERI, Hook. Fl. Bor. Am. vol. i. p. 111.

*H. CONCINNUM*, Benth. Pl. Hartw. No. 1670. "Suffruticosum, glabrum, ramis herbaceis teretibus vel superne compressis; foliis oblongis, sessilibus, semiamplexicaulibus, opacis, subtus nigro-punctatis; cymis confertis paucifloris, sepalis ovatis acutis glanduloso-dentatis, lineatis, petalorum dimidium æquantibus; staminibus numerosis, obsolete triadelphis; stylis 3-distinctis, suberectis."

"Stems ligneous at base, numerous, erect, simple, half a foot high. Leaves tough, 8—10''' long, 2''' broad, with a sharp acumination, entire, sparingly nigro-punctate, the middle rib somewhat prominent, veins inconspicuous. Flowers 3—7 together at the summit of the stems, of the size of those of *H. perforatum*. Pedicels short, with two opposite bracteoles, half the length of the calyx. Petals yellow, almost equal, 3½''' long, mucronate-acute, margins irregularly crenulate with a few glands and sometimes 1—2 acute teeth; the middle rib bestrewed with long linear and almost parallel glands, and the whole surface sprinkled over with oblong black dots; anthers also dotted black. Ovary quite triangular, with a trilobed apex. Styles longer than the ovary. On high land. July and August."

## CARYOPHYLLACEÆ.

ARENARIA (ALSINE) DOUGLASSII, Fenzl. in Hook. and Arn. Beechey, suppl. p. 325.

SILENE GREGGII, Gray, Pl. Wright, part ii. p. 17.

*S. CALIFORNICA*, spec. nov.? Caulis subramosus, debilis, pubescens, foliis caulinaribus oblongo-lanceolatis, integris, ciliatis, fere semiamplexicaulibus; cymis trifloris; calyce ample elliptice-cylindrico, obscure striato, pubescente, dentibus late ovatis, margine membranaceo ciliato; petalis purpureis magnis quadrifidis, lobis mediis amplis, profunde partitis, obtusis, lateralibus minoribus acutis, unguiculis latis, ciliatis; staminibus tubo exsertis.

This plant, of which I have several other specimens collected at Calaveras by Dr. Heermann, may be the *S. Virginica* of Benth. Pl. Hartw.; but its characters are so constant that I feel justified in separating it from that species, which it resembles at first sight. It is more pubescent, the stem and calyx less striate than in the latter, and I have not seen more than three flowers in each cyme, whilst *S. Virginica* has generally more, and *S. rotundifolia*, with which it has likewise some affinity, has them solitary or in twos. Its habits are also very different from those of *S. regia* and *S. Greggii*, which are robust and erect plants, with thickish oval or obovate leaves. In *S. regia* the petals are entire, in *S. Greggii* they are 4-fid with linear lobes, in

*S. Californica* the middle lobes are considerably larger than the lateral. Internodes 2—4 inches long. The calyx is not clavate, but uniformly expanded and perfectly cylindrical, with delicate striæ. The laminæ of the petals are always four-lobed, two large obtuse lobes in the centre and two smaller and acute on the sides. Flowers deep scarlet. Hills of D  er Creek. May.

*S. CALIFORNICA*, var. *miniata*, var. nov. Caulis erectus, simplex, 6—8 pollicaris, foliis ovato-lanceolatis acutis, basi attenuatis, sessilibus; internodiis 1—1½ pollicaribus; cymis 3-floris; calyce omnino conformi *S. Californicæ*; petalis miniatis, bilobatis cum dentibus lateralibus duobus.

The most striking characters of *S. Californica* are the tubular form of the calyx and the four-lobed petals; in the variety *miniata* the petals are not exactly four-lobed, the lateral teeth are too small to be accounted lobes, but the calyx and the claws of the petals are exactly the same. The latter might, however, prove to be a new species, if the minium color of its flowers is constant. Its leaves differ in being oval-lanceolate and more attenuate at base than *S. Californica*; it is also a smaller plant, with comparatively short internodes. Dr. Heermann brought it from Calaveras, mixed with specimens of *S. Californica*.

*S. MULTICAULE*, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 192.

#### PORTULACACEÆ.

*SPRAGUEA UMBELLATA*, Torrey, Pl. Frem. in Smiths. Contr. 1853, p. 4, Pl. I. A new and beautiful genus, belonging to the family of the *Portulacaceæ*, and dedicated to Isaac Sprague, the able botanical draughtsman of Prof. Gray's *Genera Illustrata*.

*ERODIUM CICUTARIUM*, L'Her. in Torr. and Gr. Fl. Am. vol. i. p. 208.

#### LIMNANTHACEÆ.

*LIMNANTHES ALBA*, Benth. Pl. Hartw. p. 301. "Foliis laxè pilosis, segmentis oblongo-lanceolatis linearibusve, sepalis ovato-lanceolatis, pilis longis albo-lanatis. Habitus et folia *L. Douglassii*. Hæc vero, præsertim folia superiora, pilis longis, laxis, albis ciliata. Flores quam *L. Douglassii* paullo majores videntur, petala alba, unicolorata et vix emarginata." Marshy ground.

#### MALVACEÆ.

*SIDALCEA HARTWEGI*, Gray, Pl. Fendl. p. 20. Wet places. July.

#### ACERACEÆ.

*ACER MACROPHYLLUM*, Pursh's Fl. vol. i. p. 267. A large tree, growing along the banks of Deer Creek.



## HIPPOCASTANACEÆ.

ÆSCULUS CALIFORNICA, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 251. Banks of Deer Creek, seven miles below Nevada.

## RHAMNACEÆ.

RHAMNUS OLEIFOLIUS, Hook. Fl. Bor. Amer. vol. i. p. 123; Torr. and Gr. Fl. Am. vol. i. p. 260.

CEANOTHUS CUNEATUS, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 267. Hills. April and May.

C. INTEGERRIMUS, Hook. and Arn. in Torr. and Gr. Fl. Am. vol. i. suppl. p. 686. Hills of Deer Creek. May.

C. SOREDIANUS, Hook. and Arn. in Torr. and Gr. Fl. Am. suppl. p. 686. Near the creek. May.

C. PAPILLOSUS, Torr. and Gr. Fl. Am. vol. i. 268. Granitic Hills. April and May.

C. PROSTRATUS, Benth. Pl. Hartw. p. 302. "Fruticulus prostratus, glaber, resinosus, foliis oppositis cuneatis, apice spinuloso 3-dentatis, coriaceis, penninervibus; thyrsis brevibus subumbellatiformibus."

"A very ramose and rigid shrub; prostrate, with branches and leaves opposite. The young shoots subangular, and afterwards terete. Stipules narrow-lanceolate, acute, fuscous, less than a line long. Leaves thick coriaceous 6—9" long, and attenuated into a short petiole, dividing at top into three triangular spinescent entire teeth or lobes, the middle of which is commonly the largest. Flowers blue, and of the size of those of *C. cuneatus* and *C. rigidus*, which it resembles very much, although a much lower shrub." Hills along the creek. May.

## LEGUMINOSÆ.

LATHYRUS VENOSUS, var.  $\gamma$ . *L. decaphyllus*, Hook. Fl. Bor. Am. vol. i. p. 159. *L. multiflorus*, Nutt. MSS.

L. VENOSUS, var.  $\delta$ . *L. pubescens*, Nutt., *L. decaphyllus*,  $\beta$ . *minor*, Hook. and Arn. Another variety which is exactly the same form as Nuttall's *L. polyphyllus*, Torr. and Gr. Fl. Am. vol. i. p. 274, except that the calyces are villous. All these forms were found on the banks of Deer Creek, in the month of August.

PSORALEA ORBICULARIS, Lindl. in Torr. and Gr. Fl. Am. vol. i. p. 304. In the specimens I have before me the spikes are not globose-ovate, as represented in the figure of Bot. Reg., but very elongated, and some more than four inches long, with a tuft of large yellow bracts, ciliate, and dotted with purple clavate glands. The upper

part of the stem and the calyces are very hairy. This is certainly one of the largest and most beautiful herbaceous plants of the family of the *Leguminosæ*, resembling the *Lupinus plumosus*. The petioles and peduncles are more than a foot long, and the round-oval leaflets are from 3" to 3½" in diameter. It grows in damp places and flowers in August.

TRIFOLIUM FIMBRIATUM, Lindl. Bot. Reg. T. 1070. Torr. and Gr. Fl. Amer. vol. i. p. 317.

HOSACKIA GRANDIFLORA, Benth. in Torr. and Gr. Fl. Am. vol. i. p. 323. Easily distinguished by its large umbellate flowers, nearly an inch long; each umbel is generally, provided with a large orbicular-ovate and sessile foliole. Granitic hills on the creek sides.

H. BICOLOR, Dougl. Bot. Reg. T. 1257. *Lotus pinnatus*, Hook. Bot. Mag. T. 2913. Torr. and Gr. Fl. Am. vol. i. p. 322. In wet places by the creek.

H. PURSHIANA, Benth. in Torr. and Gr. Fl. Am. vol. i. p. 327. A small form.

H. (MICROLOTUS) BRACHYCARPA, Benth. Pl. Hartw. p. 306. "Annua, â basi ramosa, villosa; foliis 4—5, obovatis oblongisve; floribus solitariis, brevissime pedunculatis, ebracteatis; dentibus calycinis lanceolato-subulatis, tubo duplo longioribus; legumine oblongo, turgido, piloso, calycem breviter superanti."

"Stem subramose, 3—4" high, leaves smaller than those of *H. subpinnata*, legume 2-3-seeded, 3—4" long, 1½" wide, divided in very thin and diaphanous cells."

Mr. Pratten's plant is very small, suffruticose and branching, softly villous throughout. Branchlets short, 3—4 flowered; leaflets 3—5, ovate or obovate lanceolate mucronulate. Stipules minute, very villous. Flowers solitary, subsessile, alternate. Calyx very villous, bilabiate, with linear subulate divisions, much longer than the tube. Legume erect, oblong, obtuse, inflated, very woolly, longer than the calyx. Seeds orbicular, compressed, deeply umbilicate. Hills. August.

LUPINUS CONCINNUS, Agardh. in Torr. and Gr. Fl. Am. vol. i. p. 372.

L. NANUS, Dougl. in Torr. and Gr. Fl. Am. vol. i. p. 373. Several forms.

L. LATIFOLIUS, Agardh. in Torr. and Gr. Fl. Am. vol. i. p. 375.

L. ALBICAULIS, Dougl. *L. falcifer*, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 378.

L. RIVULARIS, Lindl. *L. labiatus*, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 376.

L. DOUGLASSII, Agardh. in Torr. and Gr. Fl. Am. vol. i. p. 380.

PICKERINGIA MONTANA, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 388. Unfortunately, as in Nuttall and Douglass's specimens, Pratten's have no fruit.

## ROSACEÆ.

CERASUS DEMISSA, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 411. A shrub, with leaves rather glaucous.

SPIRÆA OPULIFOLIA, Linn. var. *multiflora*, var. nov. Leaves small, glabrous; pedicels pubescent, with a stipitate bract at the base; calyces tomentose. Flowers about fifty in a hemispherical umbel.

S. DOUGLASSII, Hook. Fl. Bor. Amer. vol. i. p. 172. Banks of Deer Creek. August.

CHAMÆBATIA FOLIOSA, Benth. Pl. Hartw. p. 308. Torrey's Pl. Frem. in contr. to Smithson. Inst., p. 11, T. vi. A beautiful little evergreen shrub of the family *Rosaceæ*, subtribe *Cercocarpeæ*, with tripinnately dissected leaves resembling a fern. Side hills along Deer Creek. November.

ROSA BLANDA, Ait. in Torr. and Gray Fl. Am. vol. i. p. 459.

R. GYMNOCARPA, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 461. Granitic hills. July.

## ONAGRACEÆ.

ZAUSCHNERIA CALIFORNICA, Presl. in Torr. and Gr. Fl. Am. vol. i. p. 486.

Banks of Deer Creek. August. I have under my eyes three very distinct forms of *Zauschneria*; one, (var.  $\alpha$ .) pubescent, narrow-leaved, with bright red calyces and corollas. The second, (var.  $\beta$ .) Mr. Pratten's plant, is villous-canescens, with broad-oval leaves; calyces of a fulvous color, longitudinally veined, and tips of petals brightly red. The third form, which might prove a distinct species, is also villous-canescens, with ovate-lanceolate acute leaves, repandly denticulate, and very much like the floral leaves of *Oenothera biennis*; calyx and corolla of a uniform bright scarlet color; flowers large, bracteate, on a long terminal spike. The latter was collected by Dr. Heermann at Posa Creek, South California.

OENOTHERA (GODETIA) BILOBA, Sp. Nov. Caulis adscendens, ramosus, subglaber, ramis virgatis; foliis lineari-lanceolatis, denticulato-repandis, basi attenuatis, petiolatis; floribus sessilibus purpureis; calycis tubo infundibuliformi; petalis anguste cuneatis, obcordato-bilobis, staminibus multo longioribus; antheris longis, reflexis; pistillo stamina valde superanti; stigmatibus purpureis, quadrifidis, lobis brevibus, subovatis; germine lineari, acuminato, pubescenti.

*O. biloba* and *O. decumbens* are, I believe, the only species of section *Godetia* having deeply bilobed petals. The flowers are moderately large, lilac color, and showy. The stamina are much shorter than the style, stigma purple, germ linear-acuminate and sessile. I have not seen the ripe capsules.

O. RUBICUNDA, Lindl. in Torr. and Gr. Fl. Am. vol. i. p. 502. Stem glabrous,

virgate, purplish; leaves subsessile, linear-lanceolate, subulately acuminate. Flowers axillary, pedicellate, in a loose raceme; calyx short, infundibuliform; corolla cyathiform, purple, with a bright orange spot at the bottom; petals flabelliform, rounded triangular, with erose margins; stamens short, erect; tips of anthers at length reflexed, style purple, stigma yellow, linear-elongated. Capsule pubescent, acuminate. A beautiful and highly ornamental species. On granitic hills. July.

Æ. PURPUREA, Curtis in Torr. and Gr. Fl. Am. vol. i. p. 504.

CLARKIA RHOMBOIDEA, Dougl. in Torr. and Gr. Fl. Am. vol. i. p. 516. Near tops of hills, along water courses. September.

#### LOASACEÆ.

MENTZELIA LEVICAULIS, Torr. and Gr. Fl. Am. vol. i. p. 535. *Bartonia lævicaulis*, Dougl. On river bars, twenty miles below Nevada. August.

#### CRASSULACEÆ.

ECHEVERIA. Incomplete specimen.

#### SAXIFRAGACEÆ.

SAXIFRAGA VIRGINIENSIS, Mich. in Torr. and Gr. Fl. Am. vol. i. p. 571.

S. PELTATA, Torr. in Benth. Pl. Hartw. p. 311. "Rhizomate crasso, repente; foliis longissime petiolatis, erectis, amplis, peltatis, orbiculatis, ambitu lobatis et inciso-dentatis, membranaceis; scapis subnudis, apice cymosis, glandulosis. Calycis tubo brevissimo, campanulato, lobis late ovatis obtusis; petalis obovali-oblongis; carpellis distinctis.

Rhizoma thick, creeping under ground as well as under water, covered over with large orbicular scales. The whole plant glabrous, but the petioles, the nerves of the leaves, and especially the inflorescence, are overspread with scabrous black glands. Leaves erect on a petiole two feet long. Lamina 6-8" in diameter, concave in the central part; lobes very unequal, ovate, the segments reaching nearly to the middle of the limb, with doubly dentate or shortly lobed margins. Scapes two feet high, with a small cuneate, lobed or dentate leaf below the cyme. Cyme multiform, sometimes 4" in diameter, ebracteate, ramose, very much like that of *S. cordifolia*. Flowers of a pale rose color. The segments of the calyx little more than a line long, foliaceous and glandular. Petals 3''' long, marcescent. Stamens 10; filaments dilated at base and lessening towards the apex; anthers ovate; ovaries glabrous, resting on a flat base, otherwise not coherent, with tips attenuate into a very short style soon becoming concave and dilated by the increase of the stigmatose part, and by the oblique

subhypocridiform margin. Ovules numerous." Grows on the banks of streams as well as in the water.

This plant is also in the collection made at Calaveras by Dr. Heermann.

BOYKINIA OCCIDENTALIS, Torr. and Gr. Fl. Am. vol. i. p. 577. Specimen in a depauperated state, and scarcely 4" high, still well characterized.

#### UMBELLIFERÆ.

SANICULA BIPINNATIFIDA, Dougl. in Torr. and Gr. Fl. Am. vol. i. p. 603.

EDOSMIA GAIRDNERI, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 612.

PEUCEDANUM UTRICULATUM, Nutt. in Torr. and Gr. Fl. Am. vol. i. p. 628.

ARCHANGELICA HIRSUTA? Torr. and Gr. Fl. Am. vol. i. p. 622.

OSMORHIZA BRACHYPODA, Torr. in Whipple's report, as yet unpublished.

"It differs from *O. brevistylis* in the very short pedicels of the fertile flowers and the fruit, also in the minute stylopodium; leaves also different, the general involucre wanting or about one-leaved. (Dr. Torr. in litt.)" The whole plant is but slightly pubescent and not hairy as is *O. brevistylis*; the configuration of the leaflets is somewhat trapezoid, shorter than in the other species, and petiolulate, with a few rounded lobes or teeth. The fruit is rather truncate below the stylopodium, the styles very short and parallel as far as the uncinat top. Near the banks of Deer Creek. July.

DEWEYA ARGUTA,  $\beta$ . "This is probably Hartweg's plant. I have it in Whipple's collection in two states; one like the original specimen of Nuttall, with pinnate leaves, but with a tendency in the lower leaflets to be compound; the other with ternately divided leaves, and the divisions quinate and pinnate. Yours belong to the latter form." (Torr. in Litt.) Not in fruit. April.

#### CAPRIFOLIACÆ.

SYMPHORICARPUS RACEMOSUS, var. *trilobus*, var. nov. Apparently a small shrub, subpubescent. Leaves 3-lobed, the middle lobe large, rhomboid-ovate, entire or dentate; the two inferior (sometimes a single one) elongated obtuse. Although I have seen occasional lobes in the leaves of different species of *Symphoricarpus*, yet this character is so constant in my specimens that I think it necessary to notice it as a new variety.

#### CORNACÆ.

CORNUS NUTTALLII, Audubon in Torr. and Gr. Fl. Am. vol. i. p. 652.

CORNUS SESSILIS, Torr. Spec. nov. ined. Frutex, foliis late-ovatis, acuminatis, basi fere acutis, pilis appressis pubescentibus, subtus pallidis; floribus flavis, umbel-

latis, unâ cum foliis nascentibus; umbellâ simplici, sessili, laxâ, involucri parvo, 4-phyllo deciduoque instructâ, pedicellis villosis; fructu ovato-oblongo.

“The leaves are broadly ovate, acuminate, rather acute at base, pubescent with appressed hairs, and pale underneath. Flowers appearing with the leaves, in a simple, sessile, loose umbel, which is surrounded by a small 4-leaved deciduous involucre; pedicels villous; drupe ovate oblong.” (Torr. in litt.)

This remarkable species belongs to the section of *Cornus* with yellow umbellate flowers, which includes the *Cornus mas* of Europe and our *Cornus florida*. So far, specimens collected by Dr. Bigelow and in Whipple's expedition, had proved insufficient for the complete description of this new species, on account of their being too far advanced in florescence; but two small specimens, just in bloom, collected by Mr. Pratten on the banks of Deer Creek, have permitted Dr. Torrey to finish his description. The latter specimens, which were only the tip of flowering branches, might have been taken, at first sight, for *Dirca palustris*.

#### LORANTHACEÆ.

PHORADENDRON JUNIPERINUM, Engelm. in Gray's Pl. Fendl. p. 58.

#### RUBIACEÆ.

CEPHALANTHUS OCCIDENTALIS, Linn. var. *Californicus*? Benth. Pl. Hartw. p. 314. “Glaberrimus, petiolis brevissimis; floribus interdum pentameris, etsi sæpius tetrameris,” &c. The leaves are rather narrower and more elongated than in the eastern species.

#### VALERIANACEÆ.

PLECTRITIS CONGESTA, D. C. in Torr. and Gr. Fl. Am. vol. ii. p. 50.

#### COMPOSITÆ.

SERICOCARPUS CALIFORNICUS, spec. nov. Caulis erectus, dense scabro-pubescent, foliis caulinaribus ovato-lanceolatis, integris, sessilibus, uninerviis; capitulis majoribus quam in cæteris speciebus, 15–20-floris, in corymbum compositum, terminalem dispositis. Involucris fere turbinatis, squamis adpressis, ovato-oblongis, obtusis, obscure uninerviis, basi pallidis, apice herbaceis; ligulis albis, pappo albido longioribus; achæniis obpyramidatis, tenuibus, pubescentibus, pappo dimidio minoribus.

Apparently a stout plant, with larger heads of flowers than any other of the known species. Radical leaves wanting, those of the stem oval-lanceolate, closely sessile, with an acuminate point, strongly uninerved, rather adpressed, about an inch long, scabrous, ciliate, entire. Heads 15–20-flowered, in a compound terminal corymb; involucre cylindrical-turbinate, scales imbricate in several series, adpressed, ovate-oblong, obtuse, obscurely uninerved, whitish-cartilaginous at base, with herbaceous

tips. Rays white, longer than the white pappus. Achenia linear-obconic, pubescent, about one half the length of the pappus. It has many points of resemblance with *Aster Menziesii*, Lindl., from which it differs, however, in its oval leaves, white rays, and achenia not compressed.

ASTER RADULA? var. nov. Heads rather larger and more numerous than in our Eastern species.

A. DURANDII, Nutt. Gambel's plants, in Jour. Acad. Nat. Sci., 2d series. Very much like Lindley's *A. falcatus*, and probably the same.

ERIGERON DOUGLASSII, Torr. and Gr. Fl. Am. vol. ii. p. 177.

SOLIDAGO CALIFORNICA, Nutt. in Torr. and Gr. Fl. Am. vol. ii. p. 203.

HELIOMERIS SIMPLEX, spec. nov. Caulis gracilis, erectus, simplex, 12—15-pollicaris, uniflorus, et pariter cum foliis, pilis albidis, appressis, basi dilatatis parce obtectus. Foliis oppositis vel alternis, lanceolatis acutis, scabris, in petiolum brevem desinentibus interdumve sessilibus, ad basim præsertim ciliatis; squamis involucralibus biserialibus, oblongo-lanceolatis acutis; radii floribus luteo-aurantiacis, oblongo-ovatis, obtusis, obscure striatis, involucro duplo longioribus, sterilibus; disci corollis fusco-purpureis; achæniis compressis, glabris, calvis.

I have the same plant from the head of Rio Laguno, collected by Dr. Heermann, and, in all my specimens, the form is the same; stem simple, erect, one-flowered, not above 15 inches high, with a small tap root. The stem and leaves are sparingly covered with appressed, simple, white scabrous hairs, squamiform at base. The leaves are about 2" apart, less than 2" long and 3" broad; they are opposite or alternate, scabrous, and ciliate, with a very short hairy petiole, or sometimes sessile. The scales of the involucre are in two equal series, oblong-lanceolate acute. Rays 12—15, oblong-oval, obtuse, obscurely striate, and of light orange color; disk corollas dark purple, with a short limb. Achenia compressed, smooth, devoid of pappus. Called by the Mexicans *Ojo de Gallo*.

AGARISTA CALLIOPSIDEA, D. C. Torr. and Gr. Fl. Am. vol. ii. p. 338.

LEPTOSYNE STILLMANII, (Gray in litt.) "Foliis inferioribus oppositis, omnibus trifidis seu pinnato—5-partitis, segmentis rachique planis, anguste-linearibus; squamis involucri externi oblongis, corollis haud annulato-barbatis; appendicibus styli florum disci haud apiculatis; radii orbiculatis, margine fungoso subrugoso cinctis; achæniis glaberrimis. In the valley of the upper Sacramento. Dr. Stillman."

"The single specimen collected is about a span high, with shorter and coarser leaves than *L. Douglassii*, and smaller heads. The scales of the exterior involucre are broader, shorter, rather fewer, and externally sparingly bearded at their base.



There is only a faint indication of the bearded ring so manifest on the tube of the disk corollas of *L. Douglassii*, nor do the achenia show a trace of the capitate hairs of that species. The appendages of the style, moreover, are very obtuse, and destitute of the abrupt and sharp tip. Still it is an undoubted congener of *L. Douglassii*. (Prof. Gray in litt.)”

I have several fine specimens of this plant, collected by Mr. Pratten at Nevada, and by Dr. Heermann at Calaveras. The scapes are simple, sparingly leafy at the base, from 5—7" high, sometimes solitary, sometimes 2—3—4 from the same root. Leaves rather succulent, opposite or alternate, the lowest radical simple, linear spatulate; the others 3—5-parted with linear spatulate segments. Flowers in my specimens as large as in *L. Douglassii*, if not larger; rays 3-toothed, of a brilliant yellow color. Evidently growing in a muddy soil.

SANVITALIA ABERTI, Gray, Pl. Fendl. p. 87.

XIMENESIA ENCELIOIDES, Cav. in Torr. and Gr. Fl. Am. vol. ii. p. 359.

HYMENANTHERUM WRIGHTII, Gray. Pl. Wright, part i. p. 116.

CHÆNACTIS HETEROCARPHA, Torr. and Gr. Fl. ined. Gray's Pl. Fendl. p. 98.

BURRIELIA GRACILIS, D. C. Torr. and Gr. Fl. Am. vol. ii. p. 378.

LAYIA (CALLIACHYRIS) FREMONTII, Gr. Pl. Fendl. part ii. p. 103. *Calliachyris Fremontii*, Torr. and Gr. in Bost. Jour. Nat. Hist. vol. v. p. 140.

“C. FREMONTII, Torr. is founded on a plant collected by Col. Fremont in his first expedition to California, in 1846. It belongs to the section *Osmadenia*, Torr. and Gr. Fl. Am. vol. ii. p. 402, but the cup-shaped stipitate gland on the floral and fasciculate cauline leaves, and the teeth of the disk corolla, are short and ovate. It differs in these respects from *C. tenella*, and thus connects the section *Osmadenia* with *Eucalycadenia*. It is stouter and more hairy than *C. tenella*, but seems to grow erect, and with but little tendency to spreading.” (Torr. in litt.)

CALLICHROA PLATYGLOSSA, Fisch. and Mey. in Torr. and Gr. Fl. Am. vol. ii. p. 395.

CALYCADENIA TRUNCATA, D. C. Torr. and Gr. Fl. Am. vol. ii. p. 401.

MADARIA CORYMBOSA, D. C. Torr. and Gr. Fl. Am. vol. ii. p. 404. Granitic hills, along the Creek. August.

ANISOCARPUS MADARIOIDES, Nutt. in Torr. and Gr. Fl. Am. vol. ii. p. 403.

HARPÆCARPUS MADARIOIDES, Nutt. in Torr. and Gr. Fl. Am. vol. ii. p. 406.

MONOLOPIA LANCEOLATA, Nutt. Gambel's plant, in Jour. Acad. Nat. Sci. vol. i. p. 175.

M. HEERMANNII, spec. nov. Herba tomentosa parvula, caulibus fere e radice racemosis, corymbosis, 3—5-pollicaribus; ramis monocephalis; foliis parallelo-linearibus, fere pollicaribus; omnibus supra medium rachis 5—7-lobatis; lobis rachique planis, obtusis, superioribus sparse dentatis; capitulis terminalibus; involucri late campanulati squamis ad medium connatis, segmentis 8, ovato-lanceolatis, valde tomentosis; radii floribus 8, ovato-oblongis, involucri plus duplo longioribus, dentibus duobus ad apicem minutissimis; styli ramulis oblongo-linearibus, basi marginatis; corollæ disci dentibus brevibus, intus asperis. Achænium maturum non vidi.

A congener of *M. bahiæfolia*, Benth. Pl. Hartw. p. 317. Only one specimen from Mr. Pratten; but I have four or five from Dr. Heermann, collected at Calaveras. *Monolopia Heermannii* differs essentially from *M. bahiæfolia* in its leaves being always 5—7-parted, whilst in the latter they are either entire or 3-lobed.

MALACOTHRIX TENUIFOLIA, Torr. and Gr. Fl. Am. vol. ii. p. 487. *Leucoseris tenuifolia*, Nutt.

MACRORHYNCHUS RETRORSUS, Benth. Pl. Hartw. p. 320. "Planta perennis, laxepiloso-lanata vel demum glabrescens, foliis lineari-lanceolatis, retrorsum pinnatifidis; involucri squamis exterioribus apice foliaceis, interioribus lineari-lanceolatis, rostro achæniis plus triplo longiore.

Same size as *M. troximoides*, with larger heads. Leaves 4—6 inches long, very acuminate, rachis larger, segments 4—8 on each side, lanceolate, retrorse, and all, as well as the apex of the leaves, terminating in a glandular callus, and some having a tooth at the base. Immature achenia with prominent ribs, beak 5''' long."

M. HETEROPHYLLUS, Nutt. Mr. Pratten's specimens are larger than those collected in Oregon by Mr. Nuttall, who represents this plant as a dwarf species. They are of the same size as those I have received from Dr. Torrey, collected by Col. Fremont; but I have others from Calaveras (Dr. Heermann's) that are not less than a foot high, with flowers from  $1\frac{1}{4}$  to  $1\frac{1}{2}$ " in diameter.

#### CAMPANULACEÆ.

CAMPANULA PRENANTHOIDES, spec. nov. Elata ramosa, foliis inflorescentiæ sessilibus, lanceolatis, acutis, basi latioribus, marginis infra medium utrinque bidentatis. Floribus cœruleis, subnutantibus, 3—5-paniculatis, spicam laxam inferne ramulosam constituentibus; calycis tubo globoso-truncato; corollis campanulatis, profunde divisis, lobis lanceolatis; stylo exerto, reflexo; stigmatibus clavatis, ramis tribus erectis brevibusque ad summum instructo. Æstivatio prenanthidis.

Stem erect, ramose, 2—3 feet high, slightly puberulent and glaucescent. Inflorescence, before the expansion of flowers, very similar to that of *prænanthes*. The upper cauline leaves are sessile, lanceolate, acute, widening towards the base, with two small teeth on each side. Flowers medium size, about  $\frac{1}{2}$ " long, blue and somewhat drooping, 3—5 paniculate, in an elongated and loose spike ramulose at base; tube of the calyx globose, truncate, with acute lobes, scarcely one-half the length of the corolla, which is campanulate and deeply divided in lanceolate lobes. Style exserted, reflex, stigma clavate, with three short and erect divisions. The specimens are very incomplete, and exhibit only the tops of the branches.

HETERODON RARIFLORUM, Nutt. In herb. Phil. Acad. Nat. Sci.

#### ERICACEÆ.

ARCTOSTAPHYLOS GLAUCA, Lindl. in D. C. Prodr., vol. vii. p. 586. Granitic hills, April.

AZALEA CALIFORNICA, Torr. and Gr. spec. nov. ined. *Rhododendron calendulaceum*, Hook. Ramis glabris; foliis obovatis, utrinque lævibus, nervis tamen subtus parce hispidis margineque ciliatis; pedicellis glanduloso-pilosis; calycis dentibus obtusis, valde ciliatis; corollæ maximæ tubo pubescenti limboque glabro; genitalibus exertissimis; antheris elongatis, apice truncato biporosis; stylo stamina superante, 2" longo, apice obconico, papilloso. Inflorescentia *A. nudifloræ* consimilis, flores tamen multo majores. Shady hills along Deer Creek.

A very large-flowered *Azalea* with obovate subglaucus leaves, smooth on both sides, although sparingly hirsute on the underneath nerves, and ciliate. Pedicels glandular-pilose; teeth of the calyx short, obtuse and ciliate; corollas light purple, with a pubescent tube and smooth limb. Stamens and pistil much exserted; anthers elongated, truncate, with two glandular pores at the summit. Style obconic, papillose, longer than the stamina, and about two inches in length. Inflorescence of *A. nudiflora*, with much larger flowers and more forward leaves.

#### PRIMULACEÆ.

DODECATHEON ELLIPTICUM, Nutt. spec. nov. ined.? Planta humilis scapo in primâ anthesi 3—5-pollicari posteaque elatiori; umbellis 5—8-floris; floribus nutantibus; foliis rotundo-spathulatis ellipticisve, in petiolum latum desinentibus et unâ cum eo  $1\frac{1}{2}$ — $1\frac{3}{4}$ " longis, margine subscarioso cinctis; involucri laciniis acutis; filamentis in annulum plane violaceum, antherarum tubo contiguum eoque fere dimidio breviorum connatis; antheris subobtusis.

Mr. Pratten's plant, as well as other specimens collected at Calaveras by Dr. Heermann, are all in the first stage of florescence and dwarfish; the scape is 5—8-flowered, 3—5" high; the leaves are round-spathulate,  $1\frac{1}{2}$ — $1\frac{3}{4}$ " long including the petiole; they are entire, with a conspicuous subscarious margin; the filaments are completely connate in a tube of a deep violet color, shorter than that of the yellow anthers and contiguous with it; the anthers, therefore, appear quite sessile, and are broader than in *D. meadia* and its varieties, and rather obtuse. Specimens collected by Mr. Nuttall, on the plains of the Columbia river, labelled by him *D. ellipticum*, and, I believe, as yet unpublished, are perfectly identical with Pratten and Heermann's plants, although in a more advanced stage of florescence and greater development of scapes and leaves; the latter, however, do not exceed  $2\frac{1}{2}$ " in length including the petiole. I suspect that Beechey's California specimens, from which Decandolle has, in part, evidently, described his *D. integrifolium*, belong also to the same species.†

† So far, four or five species of Dodecatheons have been described; but there is such a discrepancy in their descriptions, and their forms are so variable, that I felt inclined to follow my highly esteemed friend Prof. Asa Grey, in uniting them all together into a single species. However, on examining attentively and comparing the numerous specimens I have before me, I can not but find at least two very distinct species and several varieties, which I divide as follows:

\* *Filamentis liberis in tubum approximatis.*

DODECATHEON MEADIA, Linn.  $\alpha$ . Foliis ovato-oblongis, integris vel repando-dentatis; umbellis multifloris; floribus nutantibus; involucri foliolis ovato-spathulatis lanceolatisve; filamentis flavis glandulâ purpureâ ad apicem instructis; antheris elongatis acuminatis. In regionibus orientalibus usque ad flumen Missouri.

$\beta$ . Var. *pauciflora*.—*D. integrifolium*, Mich. non D. C. Foliis oblongo-ovalibus integerrimis (nonnunquam repando-dentatis); umbellis paucifloris, 3—5; floribus suberectis, dense purpureis; antheris atro-violaceis; bracteolis linearibus. Ad orientem et occidentem fluminis Missouri usque ad Montes Scopulosos.

$\gamma$ . Var. *integrifolia*.—*D. integrifolium*, Nutt. non Mich. neque D. C. *D. frigidum*? Cham. Foliis numerosis, congestis, oblongo-ovatis, et una cum petiolis vix 3-pollicaribus. Scapo 5—10-floro, 6—10" alto; involucri foliolis lineari-lanceolatis acutis, nonnunquam longissimis; floribus breve pedicellatis, suberectis, albis, vel purpureis. Vidi specimen e regione arcticâ, *D. frigidum* inscriptum, omnino consimile. Habitus à præcedentibus dissimilis atque minor; forte species distincta? In regionibus Oceani Pacifici.

\*\* *Filamentis in tubum connatis.*

D. ELLIPTICUM, Nutt. Partim *D. integrifolium*, D. C.; partim *D. frigidum*, Cham. in D. C. Prodr. In Californiâ et Oregon. Nuttall, Beechey, Heermann, Pratten.

I have examined, in Mr. Kilvington's garden, an abundance of seedlings of Dodecatheon in flower, obtained from different sources; but all from the species *D. meadia*, var.  $\alpha$  and  $\beta$ . In the former the flowers are hanging, and vary in color from white to lilac and different shades of purple; the anthers and filaments are yellow, the glands deep purple. The leaves are from 4—8" long. In the latter the flowers are generally erect, of a deep purple color, with violet anthers and yellow filaments; the leaves are oval, oblong, entire, but sometimes coarsely dentate and not marginate. In both the anthers are very acuminate, and the filaments free, remote, or somewhat approximated, but never connate as in *D. ellipticum*. I have not seen *D. dentatum* of Hooker, but I suspect it to be the var.  $\beta$ , with dentate leaves, as I have seen some, remarkably so, in Mr. Kilvington's garden. Some seeds were obtained from the far west, and I have no doubt that var.  $\beta$ , came from that region; the rest were from Harper's Ferry, Virginia, and the Southern States.

TRIENTALIS LATIFOLIA, Hook. Fl. Bor. Am. vol. ii. p. 121. A variety of *T. Europæa*.

#### APOCYNACEÆ.

APOCYNUM ANDROSÆMIFOLIUM, Linn. Two varieties; one with round-oval leaves; the other, with very small flowers, oval-lanceolate and glaucous leaves, may, afterwards, prove to be a new species? Only one specimen of the latter.

#### ASCLEPIADACEÆ.

ASCLEPIAS LONGICORNU, Benth. in D. C. Prodr. vol. viii. p. 570.

ACERATES CORDIFOLIA, Benth. Pl. Hartw. p. 323. "Cauli glabro, foliis sessilibus, cordato-ovatis, glabris; umbellis ad apicem caulis subpaniculatis; pedicellis calycibusque pilosis; corollæ laciniis ovatis; cucullis superne à gynostegio discretis æquilongisque.—Caulis elatus. Folia 3" longa, 2" lata vel summa minora, angustiora, acuta, margine vix ciliolata, basi auriculis rotundato-cordata. Flores fusco-purpurei, iis *Asclepiadis curassavicæ* paullo majores. Gynostegium subsessile; cuculi apice truncati, intus acutangulari." Looks very much like the *Asclepias obtusifolia*.

#### GENTIANACEÆ.

ERYTHRÆA MUHLENBERGII, Griseb, in D. C. Prodr. vol. ix. p. 60.

FRASERA NITIDA, Benth. Pl. Hartw. p. 322. "Caulibus subsimplicibus foliisque linearibus glaberrimis, cymis densifloris in thyrsum terminalem dispositis, foveis oblongis solitariis, coronæ filamentis in squamas incisas cum staminibus alternantes connatis."

I see very little cause for separating this from *F. albicaulis*. It seems to differ only in being perfectly glabrous.

#### HYDROPHYLLACEÆ.

NEMOPHILA MACULATA, Benth. Pl. Hartw. p. 324. "Caule diffusâ, foliis oppositis, pilosis, ciliatis, 3—5—7-pinnati-partitis, lobis integris, obtusis, mucronatis, pedunculis foliis longioribus, calycis segmentis ovato-lanceolatis, brevissime appendiculatis; corollâ rotato-campanulatâ, calycem plus duplo superante, albâ, lobis obovatis integris, purpureo ad apicem maculatis."

A beautiful and highly ornamental species, with larger flowers than *N. insignis*. Corollas white, with a large purple spot at the top of each division and longitudinal veins. In wet places. May.

N. INSIGNIS, Benth. in D. C. Prodr. vol. ix. p. 290. Same locality.

ELLISIA CHRYSANTHEMIFOLIA, Benth. in D. C. Prodr. vol. ix. p. 292.

E. MICROCALYX, Nutt. in Trans. Am. Phil. Soc. N. S. vol. v. p. 191, D. C. Prodr. vol. ix. p. 292.

#### POLEMONIACEÆ.

PHLOX DIVARICATA, var. *occidentalis*. Ramis longis, divaricato-corymbosis, foliis quam in specie atlanticâ minoribus, in infimis axillis nonnunquam fasciculatis; calycis laciniis lineari-lanceolatis, etiam comparate brevioribus; corollæ limbo profunde bilobo.

More rigid than the eastern species, with smaller and narrower leaves, somewhat fasciculate in the axils; segments of the calyx shorter; limb of the corolla rather larger and more deeply bilobed.

COLLOMIA GILIOIDES, Benth. in D. C. Prodr. vol. ix. p. 308.

C. GRANDIFLORA, Dougl. in D. C. Prodr. vol. ix. p. 308.

NAVARRETIA PUBESCENS, Hook. in D. C. Prodr. vol. ix. p. 309.

N. SQUARROSA, Hook. in D. C. Prodr. vol. ix. p. 309.

GILIA (CHRYSANTHA) FILIPES? Benth. Pl. Hartw. p. 325. "Caule tenui dichotome-ramoso, foliis oppositis, palmatim 5—7-fidis, segmentis linearibus, pedicellis e dichotomiis, filiformibus, elongatis; corollâ subcampanulatâ, tubo brevissimo. Habitus fere sectionis Dactyliphylli, sed folia omnia opposita videntur.—Caules e basi laxè ramosi, ramis gracilibus rubentibus, leviter scabro-puberulis. Foliorum segmenta anguste rigidula, fere subulata, 3—4'' longa, pedicelli gracillimi ultra pollicem. Corolla 3'' longa, magis aperta quam in Eugiliis, non tamen subrotata ut in Dactyliphyllis."

I have very little doubt that Mr. Pratten's plant is the above described, although the branches are perfectly smooth and the leaves so rigid as to be almost spinescent. There are no good flowers to judge from.

G. CAPITATA, Dougl. in D. C. Prodr. vol. ix. p. 311.

G. TRICOLOR, Benth. in D. C. Prodr. vol. ix. p. 312.

G. GRANDIFLORA, Steud. in D. C. Prodr. vol. ix. p. 315.

#### BORAGINACEÆ.

CYNOGLOSSUM GRANDE, Dougl. in D. C. Prodr. vol. x. p. 153.

ERIODYCTION GLUTINOSUM, Benth. in D. C. Prodr. vol. x. p. 183. On porphyritic hills. May.

#### SCROPHULARIACEÆ.

COLLINSIA PARVIFLORA, Dougl. in Bot. Reg. T. 1082, D. C. Prodr. vol. x. p. 318.

*C. TINCTORIA*, Benth. Pl. Hartw. p. 328. "Caule glabro elato, foliis inferioribus petiolatis, ovatis oblongisve, superioribus sessilibus, subcordato-lanceolatis, serrato-crenatis, supra glabris, subtus pubescentibus; floralibus parvis inflorescentiâque glanduloso-pubescentibus; verticillastris multifloris, pedicellis calyce brevioribus; calycis glanduloso-villosi laciniis lanceolato-oblongis, corollâ subtriplo brevioribus."

Stem glandular-viscous, smooth; cauline leaves  $1\frac{1}{2}$ —2" long, lanceolate-obtuse, dentate-serrate at top, closely sessile and subcordate; floral leaves narrower, entire; verticils 5—8, crowded; calyces glandular-villous, with segments much shorter than the corolla; flowers smaller than those of *C. bicolor*, and about the same size as those of *C. bartsiaefolia*.

*C. BARTSLÆFOLIA*, Gray, in D. C. Prodr. vol. x. 318.

*C. BICOLOR*, Benth. in D. C. Prodr. vol. x. p. 318.

*PENTSTEMON HETEROPHYLLUS*, D. C. Prodr. vol. x. p. 330. Bot. Reg. T. 1899.

*MIMULUS CARDINALIS*, Dougl. in D. C. Prodr. vol. x. p. 370. Banks of Deer Creek. August.

*M. SCOULERI*, Hook. Fl. Bor. Amer. vol. ii. p. 100, D. C. Prodr. vol. x. p. 371. Same locality.

*M. LUTEUS*, Linn. in D. C. Prodr. vol. x. p. 368.

*M. MOSCHATUS*, Dougl. D. C. Prodr. vol. x. p. 372.

*M. PRATTENII*, nov. sp. Planta humilis, erecta, 3—5" alta, hirsuta; foliis oppositis, 2—3-paribus, sessilibus, lineari-lanceolatis; floribus 3, in sicco luteis; pedicellis in axillâ foliorum superiorum inæqualibus; calyce angulari, striato, maculisque violaceis consperso.

Incomplete specimens. A dwarfish plant, slender, erect, 3—5" high, hirsute; leaves 2—3 pairs, opposite, sessile, linear-lanceolate; flowers 3, yellow in the dry state, on unequal pedicels, starting from the axil of the upper pair of leaves; calyx angular, with alternate white and green lines, besprinkled with violet dots.

*EUNANUS TOLMIÆI*, D. C. in Prodr. vol. x. p. 374.

*E. DOUGLASSII*, D. C. in Prodr. vol. x. p. 374.

*ORTHOCARPUS PURPURASCENS*, Benth. in D. C. Prodr. vol. x. p. 536. On hills. July.

*O. (TRIPHYSARIA) LACERUS*, Benth. Pl. Hartw. p. 329. "Erectus, durus, ramosus, pubescenti-hirsutus, viscidus; foliis 1—3-nervibus, à medio ad apicem pinnati-



fidis, laciniis longe linearibus, spicis densis non coloratis (in sicco fusco-virentibus) dentibus calycinis lineari-lanceolatis, acutiusculis; corollæ puberulæ tubo exerto, galeâ acutâ, labii appendiculis brevibus, acutis, antheris bilocularibus."

*Orthocarpus lacerus* has a great affinity with *O. lithospermoides*; but the leaves are more incised, the spikes less dense, the bracts almost palmately 5—7-partite, not turning yellow by drying, and pubescence more green. In the latter the corolla is yellow, and rose colored in the other. It is easily distinguished from *O. hispidus* by its much larger corolla and conspicuously saccate lip.

#### OROBANCHACEÆ.

ANOPLANTHUS FASCICULATUS, Walp. *Orobanche fasciculata*, Nutt. *Phelipea fasciculata*, Spreng. in D. C. Prodr. vol. xi. p. 42.

#### LABIATÆ.

PYCNANTHEMUM CALIFORNICUM, Torr. ined. Herba rigida, erecta, foliis ovato-lanceolatis, acuminatis, integris, basi rotundatis, sessilibus, tomentoso-canescens, pellucido punctatis. Capitulis axillaribus terminalibusque; bracteis exterioribus foliaceis, interioribus setaceis, villosissimis; floribus parvis, numerosis; calyce tubuloso, obconico, dentibus brevibus, valde tomentosis; corollâ in sicco ochroleucâ, purpureo sparse punctatâ, tubo calycem æquante; staminibus exertis, antheris violaceis.

The whole plant canescent-tomentose; stem quadrangular, rigid, 15—18" high; leaves sessile, cordate, oval-lanceolate, entire or with a few small teeth, veined and sprinkled over with small pellucid glands. Capitula axillary and terminal, very crowded; exterior bracts foliaceous; interior setaceous and very villous. Flowers pale yellow, with a few small purple dots. Calyx tubular, striate, tomentose, as long as the tube of the corolla. Stamens exerted, with purple anthers. A very aromatic plant, nearly as pungent as *Monarda punctata*.

MONARDELLA SHELTONI, Torr. in litt. "Erecta suffruticosa? puberula, foliis ovato-oblongis, petiolatis, subobtusis, integris vel obscure et remote repando-denticulatis; bracteis exterioribus oblongis, calyce tubuloso, dentibus brevibus, lanceolatis, muticis; verticillastris terminalibus."

This species is easily distinguished from the others by its more exerted corollas, villous tubes, and very long linear lobes protruding about half an inch above the teeth of the calyx.

M. CANDICANS, Benth. Pl. Hartw. p. 330. "Annua, erecta, canescenti-tomentella; foliis petiolatis, anguste oblongis, subintegerrimis; bracteis exterioribus ovatis, acutiusculis; calycis tubulosi dentibus brevibus, muticis."

Herbaceous, ramose, sparingly leaved, a foot high or a little over; branches oppo-

site, subfastigate. Leaves 1—2" long, almost similar to those of *M. odoratissima*, but tapering at base into a somewhat long petiole. Capitula more numerous and smaller than in the other species, and always terminal and solitary at the top of the branches. Bracts veined, pubescent, 3" long. Calyces densely villous about the teeth.

*M. ODORATISSIMA*, Benth. in D. C. Prodr. vol. xii. p. 190.

*POGOGYNE PARVIFLORA*, Benth. in D. C. Prodr. vol. xii. p. 243.

*AUBERTIA HUMILIS*, Benth. in D. C. Prodr. vol. xii. p. 359. April.

*BRUNELLA VULGARIS*, var.  $\beta$ . D. C. Prodr. vol. xii. p. 411.

*SCUTELLARIA ANGUSTIFOLIA*, Pursh. Fl. Am. vol. ii. p. 412, D. C. Prodr. vol. xii. p. 424.

*S. TUBEROSA*, Benth. D. C. Prodr. vol. xii. p. 229. A dwarfish species, very pungent when green. August.

*STACHYS PRATTENII*, spec. nov. ? Humilis, robusta, hirsuto-pilosa, foliis sessilibus, oblongo-ovatis, obtusissimis, ad basim serratis, ad apicem crenulatis, mediâ costâ prominente, albidâ subtus instructis; calycibus pilosis, dentibus brevibus, ovatis, subæqualibus; verticillis 5—6-floris.

Stem robust, hirsute-pilose; lower leaves about 2" long, sessile, oblong-ovate, obtuse, dentate at base, and crenulate towards the top, with a prominent white rib underneath; calyces villous, with short ovate teeth, almost equal; verticils from 5—6 flowers. Aff. *S. pilosæ*, Nutt. The unique specimen in the collection is about 8 inches high. Hilly sides of woods. June.

*TRICHOSTEMMA OBLONGUM*, Benth. in D. C. Prodr. vol. xii. p. 573. A variety. Mr. Pratten's specimens have ovate leaves; the whole plant, especially the stem, cymes and margin of the leaves, is remarkably softly villous, with hairs 2—3" long.

*T. LANCEOLATUM*, Benth. in D. C. Prodr. vol. xii. p. 573. Very aromatic.

#### POLYGONACEÆ.

*ERIOGONUM DICHOTOMUM*, Dougl. in Trans. Lond. Linn. Soc. vol. xvii. p. 415.

*E. NUDUM*, Dougl. in Trans. Lond. Linn. Soc. vol. xvii. p. 413.

*E. VIMINEUM*, Dougl. in Trans. Lond. Linn. Soc. vol. xvii. p. 410.

*E. PRATTENIANUM*, spec. nova? Specimen incompletum. Sectio *Genitalia glabra*, Benth. Pedunculi subnudi, purpurascens, semipedales vel longiores, verticillo foliorum 4, ovalium, breve pedunculorum supra basim muniti. Umbella terminalis,

globosa, multiflora; involucrium maximum, campanulatum, lanugine densâ tectum, brevi-dentatum; perianthiis exertis, glabris, purpureis? in sicco ochroleucis.

Mr. Pratten collected only two specimens, one without, the other with a verticil of four small, oval and shortly-petioled leaves a little above the base of the glabrous scape; umbel terminal, globose, very crowded; involucre large, very lanuginous, with short oval-acute teeth; perianths exserted, glabrous, probably purplish, but yellow in the dry state. Radical leaves wanting.

## CONIFERÆ.

JUNIPERUS VIRGINIANA, Linn. Mich. Syl. Am. vol. iii. p. 191. T. 155.

## ORCHIDACEÆ.

GYMNADENIA LONGISPICA, sp. nova. (specimen cui folia radicalia desunt.) Scapo gracili, erecto, fere pedali; foliis 4 infra spicam, parvulis, bracteiformibus, ovato-lanceolatis; spicâ circiter 50-florâ, gradatim ad apicem gracilescenti, 7" longâ; bracteis lanceolatis, ovaria æquantibus; floribus minimis, albis? in sicco fuscantibus; corollis cernuis, sepalis subæquantibus, labio integro, calcare tenui, clavato, ovario longiori.

The spike is very long, tapering, with at least fifty flowers. Sepals and petals almost equal, lip entire, spur longer than the germ, filiform, clubshape, with a much longer spike than *Spiranthes bracteosa* of Lindl. in Bot. Reg. T. 1934, to which *Gymnadenia longispica* has a great resemblance. The inflorescence seems spirally twisted round the scape.

## LILIACEÆ.

CALOCHORTUS VENUSTUS, Benth. in Hort. Trans. vol. i. N. S. p. 412.

C. ELEGANS, Pursh. Fl. Am. vol. i. p. 240.

CYCLOBOTHRÆ PULCHELLA, Benth. in Hort. Trans. vol. i. N. S. p. 415.

C. ALBA, Sweet. Bot. Reg. T. 1661.

FRITILLARIA LANCEOLATA, Pursh. Fl. Am. vol. i. p. 230. Mr. Pratten's specimens are, evidently, the same as Pursh's plant, although bearing from 2—4 flowers. One specimen with a whorl of 3 leaves at the base is 14" long and has 4 flowers. The whole plant is slightly pubescent; the leaves are linear-lanceolate, parallel-veined, those of the whorl about 4" long. Between the whorl and flowers the scape is naked; but each flower is in the axil of a leaf longer than the recurved peduncle. Flowers campanulate, purplish, with darker spots, more than one inch diameter at top; petals narrow-lanceolate, longer than the stamina. Pistil and ovary minutely hispid. In wet places around Nevada. May.

F. PARVIFLORA, Torr. ined. (for Whipple's report.) Scapo 6—12 pollicari, floribus 3—4, cernuis, parvis, pallide-purpureis, haud maculatis; foliis verticillatis, oppositis alternisve, lineari-lanceolatis, venosis, obtusis vel acuminatis. Corollis pubescentibus, campanulatis; petalis ovato-lanceolatis, striatis; staminibus inclusis.

A smaller plant than the above, with small drooping flowers without dots. Leaves linear-lanceolate, veined, obtuse or acuminate, in verticils of threes, in twos or alternate. Corollas pubescent, campanulate; petals oval-lanceolate, purplish-white, striate; stamens included, unequal, a little shorter than the pistil; stigma recurved.

LILIUM SUPERBUM, Willd. Spec. Plant. vol. ii. p. 88.

BRODIEA GRANDIFLORA, Pursh. Fl. Am. vol. i. p. 223. In damp places fully exposed to the sun.

B. GRANDIFLORA, var. *macrantha*, Torr. A larger plant than the preceding, bearing an umbel of 6—8 flowers, on erect and unequal peduncles, some of which are not less than 4—5" long. Perigonium  $1\frac{1}{2}$ — $1\frac{3}{4}$ " in length, and more than 1" diameter at top, not inflated at base, even when the germ has attained a considerable size; otherwise not differing materially from *B. grandiflora*, which is a much smaller plant.

DICHELOSTEMMA CONGESTUM, Kunth. Enumeratio plant. vol. iv. *Brodiea congesta*.

HESPEROSCORDON LACTEUM, Lindl. Bot. Reg. T. 1639. Hook. Fl. Am. Bor. Am. T. 148.

CALLIPRORA LUTEA, Lindl. Bot. Reg. T. 1590.

SEUBERTIA LAXA, Kunth. Enum. plant. vol. iv. A most beautiful bulbous plant, with a naked scape, above one foot high, bearing at its summit an umbel of from 8—50 large blue flowers. These are supported by unequal petioles, articulated with the perigonium. Corolla infundibuliform, with an obconic slender tube; limb six-parted; divisions oval-lanceolate. Filaments of the anthers short, somewhat dilated, inserted on the throat of the corolla; ovary long-stipitate, globose, with a short style crowned with a simple, blunt, and somewhat papillose stigma. Leaves linear, canaliculate, shorter than the scape.

ALLIUM FALCIFOLIUM, Hook. and Arn. in Bot. Beechey's voy.

Another ALLIUM, with naked scape and small umbel of white flowers. Specimen too imperfect for examination, and, I think, a new species.

ECHEANDIA TENUIFOLIA, Orteg. Kunth. Enum. pl. vol. iv.

CHLOROGALUM POMERIDIANUM. (*Soap-plant*.) Kunth. Enum. pl. vol. iv. p. 682. *Anthericum pomeredianum*, Gawl. in Bot. Reg.

SCHÆNOLIRION ALBUM, sp. nova. Racemo simplici, circiter 50-floro, 10 pollicari; bracteis lineari-lanceolatis, membranaceis; perigonii patenti foliolis ovalibus, concavis, 3-nerviis, persistentibus, basi breviter connatis, ad apicem glandulis minimis linearibus ciliatis; staminibus 6, stylum æquantibus; stylo filiformi, in stigma obsolete 3-dentatum attenuato; ovario subsessili, 3 loculari, ovulis tantummodo duabus in loculamentis.

Of this beautiful plant I had only fragments of the raceme, without scapes or leaves.

SCHÆNOLIRION is a new genus founded by Prof. Torrey on the *Phalangium croceum* of Mich., *Ornithogalum croceum* of Ell., which will soon be published in Whipple's report. "It differs from *Phalangium*, in the root being bulbous and the cells of the ovary 2 (not several) ovuled, as well as in other characters; from *Ornithogalum*, in cells not 6—8 ovuled, style not capitate 3-lobed; from *Scilla*, in the same characters; from *Asphodelus*, in sepals distinct, or nearly so, at base, and 3-nerved, not divided and uninerved, stigma not capitate 3-lobed, nor root fibrous-fasciculate. The genera with which it is most allied are *Camassia* and *Chlorogalum*." Torr. in litt.

#### DIOSCOREACEÆ.

TRILLIUM SESSILE, var. *giganteum*, Hook. and Arn. in Bot. Beechey's voy. p. 402. The three involucral leaves have a diameter of 8 inches; each leaf is  $4 \times 4''$ , rhomboid acute and strongly veined; the petals are purple, rhomboid-lanceolate  $2\frac{1}{4}''$  long by  $1\frac{1}{8}''$  wide.

#### MELANTHACEÆ.

LEIMANTHIUM NUTTALLII, Hook. Fl. Bor. Amer. *Helonias angustifolia*, Nutt. *Amianthium Nuttallii*, Gr. Melanth. in Ann. Lyc. N. York, Vol. iv. p. 123.

VERATRUM CALIFORNICUM, sp. nova. Caulis robustus, foliosus, pubescens, foliis ovato-lanceolatis, acuminatis, plicatis, glabris, imis caularibus in petiolum attenuatis et cum eo circa pedalibus; superioribus sessilibus, subvaginantibus. Racemo valde pubescenti, paniculato et circiter pedali; floribus breve pedicellatis, polygamis; sepalis ovatis obovatisve, persistentibus, in sicco fuscis et purpureo ad basim maculatis, antheris reniformibus posticis, antice dehiscentibus; stylis brevibus, recurvis.

This is undoubtedly different from *V. viride* of which I have specimens from Oregon, perfectly similar to our eastern plant, except that the leaves are almost round. The color and shape of petals differ entirely; *V. viride* has greenish flowers with narrow

elongated petals drying green; *V. Californicum*, on the contrary, like *Melanthium virginicum*, dries purple, and has ovate sepals, marked at the base with a deep brown spot. The bracts in *V. viride* are very long and narrow, those of *V. Californicum* are scarcely longer than the short pedicel, and are oval and concave; the leaves also are quite different; they are broadly ovate in the former, and oval-lanceolate in Mr. Pratten's plant.

## JUNCACEÆ.

LUZULA CAMPESTRIS, D. C., in Gray's Bot. of the Northern States, p. 505.

## CYPERACEÆ.

CAREX. Not sufficiently advanced.

## GRAMINEÆ.

CALAMAGROSTIS CANABENSIS, Beauv. *C. Mexicana*, Nutt. in Gray's Bot. of Northern States, p. 582.

FESTUCA DURIUSCULA? Linn. in Gray's Bot. of Northern States, p. 599.

HORDEUM PUSILLUM, Nutt. in Gray's Bot. Northern States, p. 604.

## FILICES.

POLYPODIUM VULGARE, Linn. Gray. Bot. Northern States, p. 622.

WOODWARDIA CHAMISSONI, Brackenridge, Bot. Exp. *W. radicans*, Hook. and Arn. Bot. Beechey's Voy.

GYMNOGRAMMA. Not new, but I had no means to ascertain the species.

DRYOPTERIS, Adans. (*Lastrea*, Bory.) Spec. nov.? Frond triangular-lanceolate glabrous, pale green. Pinnæ linear-lanceolate acute, alternate, more than 20. Pin-nulæ also above 20, obovate-oblong, obtuse, sharply and pinnately toothed. Fruit dots between the sinuses. Indusium smooth. Near *D. Intermedia* et *D. dilatata*.

## LYCHENES.

EVERINA VULPINA, Ach. Fide Mr. Laning.

CETRARIA, near *Ciliaris*, if it be not that species. Fide Mr. Laning.

C. PLACORIDIA, Tuck. Fide Mr. Laning.

ART. X.—*Relation of Atomic Heat to Crystalline Form.*

By J. AITKEN MEIGS, M. D.

Very probably in the atomic constitution of matter we are to seek the true material basis of the whole Science of Nature. The unity of Natural Science—as displayed in the mutual relations and connections of its different parts—here finds a positive expression. Therefore, Natural Science, as a unit, becomes philosophically intelligible in proportion to the clearness and accuracy of our views concerning the aggregation of passive atoms or ultimate particles into Forms,—whether organic or inorganic, whether specifically or generically impressed. But the comprehensive study of such aggregations, requires the contemporary investigation of the physical agent which brings together inert atoms and retains them in contact,—which preserves as well as produces the form.

Under the influence of the attractive principle, matter everywhere tends determinedly to assume a definite shape. Hence crystallization is perceived to be as common a characteristic of the inorganic, as vitality is of the organic world. Yet if we may judge from the standard works of the day, upon these subjects, the cause of the one is involved in as much obscurity as that of the other.

A crystal is inanimate matter individualized, or endowed with a form, in virtue of which it approximates the unorganized to the organized kingdom. The difference between the most complex crystal and the simplest plant is of course extreme; but while on the one hand physiologists have carefully detailed these differences; on the other, they seem to have lost sight of the striking analogies which exist between the *seriate* results produced alike in the crystalline and the animal and vegetable worlds, by a methodical intermittency of action, on the part of their respective developing agents. Thus the concentric layers of wood in the trunk of a tree, between which lines of demarcation are more or less evident,—as is especially the case between the duramen and alburnum of the *lignum vitæ* and the coco-wood,—indicate the successive periods of activity and repose of the formative principle. So the lines of cleavage in a crystal silently assure us that the attractive power is intermittent in action, and that along these weak planes it had ceased its exertions for a while, or, at least, had acted very feebly.\* Among the numerous and beautiful forms assumed

\* Dana. Amer. Journ. of Science and Arts, 2d ser., vol. iv., p. 378, —v., p. 100.



by snow-crystals, we find specimens from whose primitive rays are given off lateral spines or branchlets in pairs, directly opposite to, and separated the same distance from each other. One basal ray with its secondary spines is the fac-simile of all the rest. Now this tendency to the repetition of precisely similar parts is seen not in the formation of a crystal only, but also in the development of the highest plants, in zoophytes and in the lower mollusca and articulata where it embraces entire groups of organs. Thus in the highest forms of the Echinodermata, five precisely similar rays are developed around a common centre. The same tendency is seen in the eight or ten tentaculæ which surround the mouths of the dibranchiate Cephalopoda. Similar examples are presented by the Annelida. In all these instances it is evident that the developing force has acted methodically from a common centre, towards the accomplishment of a definite end or object—the production of a special form. In classification, form is of the highest value to the practical naturalist. But form is not fundamental, it is merely secondary; it is the effect of the action of the developing cause upon ponderable matter. Aided by a severe and cautious logic, the careful and elaborate study of comparative morphology, it is reasonable to hope, will enable us to advance from the known to the unknown, from the multitudinous forms of natural objects to their physical cause. Moreover, it will probably lead to the discovery of profound analogies between the organic and the inorganic worlds,—analogies manifested through similarity in the modes of action of the formative or developing principle.

Crystallization naturally constitutes the first chapter in the history of comparative morphology. A knowledge of crystallization is of prime importance to the chemist and mineralogist in assisting them to arrange bodies in their natural groups; to the natural philosopher in elucidating the laws of cohesive attraction; to the physiologist, since it promises to throw considerable light upon the function of a fundamental physical agent, the analogy of whose method of action with that of the developing principle in the organic world, will lead, if not to their identification, at least to more definite knowledge of the phenomena of growth; to the physician, as it affords some clue to the pathology of symmetrical diseases; and lastly to the philosophic naturalist, from its relation to organic morphology, through which, perhaps, will be attained that much desired result, the demonstrative proof of a great general or archetypal plan of organization.

A diligent and attentive inquiry into the rationale of the phenomena of isomorphism and dimorphism would dissipate much of the mystery that hovers about the cause of crystallization in general; and even, perhaps, illuminate many obscure parts of organic science.

Towards the accomplishment of so desirable a result, an important step was made

by Mitscherlich, who from his elaborate researches deduced the well-known law, that the same number of atoms combined in the same way produce the same crystalline form, and that crystalline form is independent of the chemical nature of the atoms, and determined by their number and relative position only. Carefully considered, however, this law is seen to reveal merely the secondary or proximate cause of any special crystalline form. It does not distinctly explain the phenomenon of isomorphism. Obviously in the power which aggregates the atoms, we are to look for the prime cause of crystallization in general. Mitscherlich's law does not clearly explain why different acids having different atomic weights and volumes, should, when combined with the same base, present the same geometrical figure. According to the atomic theory, the ultimate atoms composing the various chemical elements differ in weight and volume. The numbers expressive of atomic weight are in some measure indicative of atomic magnitude, otherwise the present great diversity in the atomic numbers of the elements and their compounds could scarcely exist. And this supposition receives very strong support from the well-known, but not duly appreciated fact, that the atomic weight of a body may be very great, while its atomic number is very small. Keeping in view this difference in atomic magnitude, it is difficult to conceive, as indeed has been objected to Mitscherlich's law, why arsenic and phosphoric acids, whose respective atomic weights are 115 and 71, should, when combined with soda, produce isomorphous compounds; why the seleniate and sulphate of soda should be identical in form, when the atomic weight of selenic acid is 64, and that of sulphuric acid 40, &c.

Again, it is a well-known fact that the same body may assume two or more distinct and unrelated forms. Thus, carbon presents us with regular octohedrons in the diamond, and six-sided plates in graphite, or plumbago. Sulphur is also dimorphous, assuming two incompatible crystalline forms. The minerals rutile, brookite and anatase are distinct crystals of titanic acid. Carbonate of lime, too, expresses itself dimorphously. Such facts as these show that as far as ponderable elements are concerned, crystalline form is by no means the consequence of an invariable atomic constitution. Moreover, isomorphism is compatible with a considerable difference in the number of atoms. Thus, according to Mitscherlich, sulphur in one of its forms is isomorphous with the bisulphate of potassa. The nitrite and the nitrate of lead have the same octohedral figure, yet the latter compound has two atoms more of oxygen than the former. Gmelin instances a number of similar examples.

Here, then, it remains to be explained why two or more acids having different atomic weights, upon uniting with the same base, assume the same crystalline form; why the same body presents us with examples of dimorphism, trimorphism, or even, as in the case of water, of polymorphism; why some substances are isomorphous both in the separate state and in combination; and lastly, why some substances replace

each other in compounds according to equal, and others according to unequal numbers of atoms.

In 1809, from his own experiments, and those performed in company with Humboldt, Gay Lussac clearly demonstrated that gases combine with each other by definite volumes as well as by definite weights, and that the volume of a gaseous compound is distinctly related to that of one or both of its constituents. Prout, Thompson and others, by their researches, afterwards showed that this law embraced vapors, and also the vapors of certain bodies which possess the elastic form only when combined with permanent gases.

Recently Dr. Hermann Kopp of Giessen has attempted to extend the volume-theory in another direction. He endeavors to show,—and with remarkable success,—that all bodies in forming chemical compounds, unite by definite volumes in addition to equivalent weights; that every body, whether elementary or compound, has a specific atomic volume; that as atomic weights are proportional, so are atomic volumes; that whilst atomic weight gives us the idea of mass, a crystal is the representative of a regular and definite volume. From considerations of this nature he enunciates the following law: “The specific weight of isomorphous bodies is proportional to their atomic weights; or, isomorphous bodies possess the same atomic volume.”\*

From the numerous examples adduced by Kopp, of the validity of this law, we may legitimately infer that the phenomenon of isomorphism may be expressed by saying, that many elementary and compound bodies tend strongly to assume the same, or, at least, but a slightly differing volume. Furthermore, all crystallization is the assumption of a form or regularly defined volume, the specifically regular outline or contour of which is dependent upon the power and freedom of the aggregating force. In the study of the volume of a body, then, is in all probability involved the study of the cause of cohesive attraction, isomorphism, dimorphism, trimorphism, polymeric-isomorphism, and all the interesting though obscure phenomena of crystallization. Evidence of a very high character exists for supposing that identity in the arrangement of atoms is the immediate predisposing cause of identity in form or volume. Sameness in number does not appear necessary, for examples exist of isomorphous bodies having unequal numbers of atoms. Reasoning in this channel, we are constrained to seek for the cause not only of isomorphism, but of all crystallization, in that force, whatever it may be, which is capable of arranging an equal or unequal number of atoms into the same volume. Now, many crystals, when once formed, will maintain themselves unchanged under very varying external conditions. Hence it may be inferred that the force which gave form to a portion of matter, which created the crystal, so to speak, must exist with and in it, otherwise that form could not be preserved. Just as in the organic world, the parent imparts its vital powers

\* London Philosophical Magazine, 3d series, Vol. 18, p. 255.

to the ovum, which, through the processes of development, growth and nutrition, is seen to act as a preservative power; when it departs, the mass of organized particles which it vivified or animated is left a prey to surrounding destructive influences.

A crystal is composed of ponderable and imponderable elements;—the former visible, gross and inert; the latter invisible, subtle, expansive and self-repellant. This imponderable is caloric, and in one of its relations it constitutes the specific heat of a body. Through all ponderable bodies it diffuses itself without exception, and accumulates in quantities varying with the peculiar nature of the ponderable substance with which it is combined. Here the question naturally presents itself to the inquiring mind, as to the *cui bono* of this caloric, its uses and relations. Its continued presence, and well-known power and activity, as compared with ponderable matter, authorize us to conclude that it is not without use, otherwise we accuse nature of superfluity, of supererogation, which is manifestly unphilosophical. The combined heat of a body, we know, is intimately connected with the existing condition or state of aggregation of that body. Variation in the one is attended with alteration in the other. Ice, water and steam are three very different forms of one and the same gaseous compound. In all, the ponderable atomic constitution is the same, but the amount of heat contained in each is very different. Diminish the heat of steam, and you convert it into water; diminish it still further, and you convert the water into ice. In this simple instance, then, and others could easily be furnished, we have beautifully manifested the extraordinary influence of caloric upon the aggregation of atoms. And yet with so simple and forcible an example before them—an example embracing the three known conditions in which it is possible for ponderable matter to exist—chemists still express themselves doubtfully as to the propriety of admitting heat as an active constituent of bodies equally essential as their ponderable elements.

In his interesting paper above referred to, Kopp has given us numerous examples which tend strongly to substantiate the relation which he contends for between isomorphism and sameness of atomic volume. Crystalline form and volume of atoms are thus closely assimilated, if not, indeed, identified. Thus far concerning the ponderable matter. Philosophical confidence in the intelligential character and immutability of nature's laws, and in the unerring exactitude of the results of those laws,—in other words, implicit faith in the fundamental and truly scientific doctrine that “nothing was made in vain,” here encourages us to advance at least one step further in the cautious investigation of this intricate subject, by attempting to ascertain the relation between the atomic volume and the imponderable element caloric surrounding the atoms of a crystal.

In the following tables, where a number of elementary and compound bodies have been grouped together isomorphously, it will be seen that for each group the numbers expressive of the atomic volumes of the different substances of that group are either

almost identical, or related to each other in a simple, multiple proportion. A still more evident similarity prevails throughout the numbers indicating the atomic heats of the same bodies. Furthermore, a remarkable relation, in some instances more manifest than in others, is observed to exist between the atomic heat of a body and its atomic volume.

The first column of the table contains the names of the substances, or, when these are compound, their formulæ only; the second, their atomic weights upon the hydrogen scale; the third, their specific gravities; the fourth, the observed specific heats, with the initials of the Experimenters attached; the fifth, the mean specific heats; the sixth, the atomic heats obtained, after the manner of Dulong and Petit, by multiplying together the atomic weight and the specific heat; the seventh, the atomic volumes, calculated according to the method of Schroöder and Kopp, by dividing the atomic weight by the specific gravity.

Av. denotes Avogadro; Dl., Dalton; D.M., De la Rive and Marcet; Hm., Hermann; Nm., Neumann; P.D., Petit and Dulong; Pr., Potter; P.J., Playfaire and Joule; Rg., Regnault.

The specific gravities adopted are generally the means of the observations made by Kopp, Karsten, Brisson, Gay Lussac and Thenard, Mohr, Breithaupt and others, the results of whose experiments are recorded in the more elaborate chemical works.

## ELEMENTARY BODIES.

Elements.	Atomic Weight	Specific Gravity.	Specific Heat.	Mean Specific Heat.	Atomic Heat.	Atomic Volume.
Sulphur	16	1.99	0.1880 P,D. 0.1900 Dl. 0.2026 Rg. 0.2090 Nm.	0.1974	3.2416 Rg. 3.15840	8.04
Selenium	40	4.31	0.0675 Hm. 0.0834 D,M. 0.0837 Rg.	0.0782	3.3480 Rg. 3.1280	9.28
Tellurium	64	6.26	0.0515 Rg. 0.0912 P,D.	0.0713	3.2960 Rg. 4.5632	10.22
Manganese	27.8	8.02	0.14411 Rg.		4.00598	3.466
Iron	27.2	7.73 7.13 P,J.	0.1054 Hm. 0.1100 P,D. 0.1130 Pr. 0.1138 Rg. 0.1300 Dl.	0.1144	3.09536 Rg. 3.1116	3.518 3.675 P,J.
Cobalt	29.6	8.57 7.989 P,J.	0.1070 Rg. 0.1172 D,M. 0.1498 P,D.	0.1246	3.1672 Rg. 3.6881	3.453 3.675 P,J.
Nickel	29.6	8.46 7.832 P,J.	0.1035 P,D. 0.1086 Rg.	0.1060	3.21456 Rg. 3.1376	3.498 3.675 P,J.
Copper	31.8	8.896 8.424 P,J.	0.0949 P,D. 0.0950 D,M. 0.0951 Rg. 0.0960 Pr. 0.0961 Hm.	0.0954	3.02418 Rg. 3.0337	3.574 3.675 P,J.
Zinc	32.3	6.99 7.21 Bz.	0.0927 P,D. 0.0929 Nm. 0.0940 Pr. 0.0955 Rg. 0.1000 Dl.	0.0950	3.08465 Rg. 3.0590	4.620 4.479 Bz.
Cadmium	55.8	8.63	0.0385 Hm. 0.0567 Rg. 0.0576 D,M.	0.0509	3.16386 Rg. 2.8402	6.465
Barium Strontium Lead	68.6 44 103.8	3.75 2.542* 11.35	0.0293 P,D. 0.0299 Hm. 0.0314 Rg. 0.0320 Pr. 0.0400 Dl.	0.0325	3.25932 Rg. 3.3735	9.145
Tin	59	7.29	0.0514 D,M. 0.0515 P,D. 0.0560 Pr. 0.0562 Rg. 0.0700 Dl.	0.0570	3.3158 Rg. 8.3630	8.093
Titanium	24.3	5.29				4.593

\* Bunsen. Comptes Rendus, Avril, 1855, p. 717.

Elements.	Atomic Weight.	Specific Gravity.	Specific Heat.	Mean Specific Heat.	Atomic Heat.	Atomic Volume.
Platinum	98.8	21.5	0.0314 P,D. 0.0324 Rg.	0.0319	3.20112 Rg. 3.15172	4.595
Palladium	58.4	11.7	0.0593 Rg.	...	3.1666 Rg.	4.564
Iridium	98.8	21.6	0.0368 Rg.	...	3.63584 Rg.	4.574
Osmium	99.7	21.8	...	...	...	4.573
Tungsten	95	17.3	0.0350 D,M. 0.0364 Rg.	0.0357	3.3915	5.491
Molybdenum	48	8.63	0.0659 D,M. 0.0722 Rg.	0.0690	3.3120	5.561
Gold	199	19.258	0.0298 P,D. 0.0324 Rg. 0.0340 Pr.	0.0320	6.3680	10.333
Silver	108.1	10.428	0.0557 P,D. 0.0570 Rg. 0.0590 Pr.	0.0572	6.1833	10.366
Sodium	23.3	0.97	...	...	...	24.123
Potassium	39.2	0.86	...	...	...	45.581
Phosphorus	31.4	1.77	0.1887 Rg. 0.2900 Hm. 0.3850 Av.	0.2879	5.92518 Rg. 9.0400	17.740
Arsenic	75.2	5.74 5.23 P,J.	0.0804 Hm. 0.0810 Av. 0.0814 Rg.	0.0809	6.0836	13.101 14.378 P,J.
Antimony	129	6.72	0.0470 Nm. 0.0496 Hm. 0.0508 Rg. 0.0520 Pr.	0.0498	6.4242	19.196
Bismuth	106.4	9.79	0.0270 Nm. 0.0288 P,D. 0.0308 Rg. 0.0330 Pr.	0.0299	3.1813	10.867
Iodine	126	4.948	0.0541 Rg. 0.0890 Av.	0.0715	9.0090	25.464 26.220
Bromine	78.4	2.99	0.1350 D,M.	...	10.5840	



## COMPOUND BODIES.

Formulae.	Atomic Weight.	Specific Gravity.	Specific Heat.	Mean Specific Heat.	Atomic Heat.	Atomic Volume.	Volume according to Kopp.
Sn O <sub>2</sub>	75.	6.960	0.0933 Rg. 0.1110 Av. 0.0900 Hm. 0.0931 Nm.	0.0968	7.260	10.775	134.38
Ti O <sub>2</sub>	40.5	3.792	0.1716 Rg. 0.1630 Hm. 0.1703 Rg. 0.1724 Nm.	0.1693	6.856	10.680	132.82
Al <sub>2</sub> O <sub>3</sub>	51.4	3.833	0.1963 Hm. 0.2000 Av. 0.1942 Nm. 0.1976 Rg. 0.1972 Nm. 0.2173 Rg.	0.2004	10.3005	13.409	168.07
Fe <sub>2</sub> O <sub>3</sub>	78.4	5.254	0.1757 Rg. 0.1681 Rg. 0.1669 Rg. 0.1692 Nm.	0.1699	13.3201	14.921	186.23
Cr <sub>2</sub> O <sub>3</sub>	80.2	5.21	0.1796 Rg. 0.1960 Nm. 0.2126 Hm.	0.1961	15.7272	15.393	192.63
MgO, CO <sub>2</sub>	42.7	2.834	0.2220 Nm.	...	9.4794	15.067	181.25
FeO, CO <sub>2</sub>	57.2	3.800	0.1934 Rg. 0.1820 Nm.	0.1877	10.73648	15.052	188.50
$\frac{1}{2} \left( \begin{smallmatrix} \text{MgO, CO}_2 \\ \text{CaO, CO}_2 \end{smallmatrix} \right)^*$	46.6	2.884	0.2174 Rg.	...	10.13084	16.158	202.36
CaO, CO <sub>2</sub>	50.5	2.735	0.1945 Hm. 0.2046 Nm.	0.1995	10.0747	18.464	231.20
CaO, CO <sub>2</sub>	50.5	2.963	0.2018 Nm. 0.2085 Rg.	0.2051	10.3575	17.043	213.47
SrO, CO <sub>2</sub>	74.	3.615	0.1445 Nm. 0.1448 Rg.	0.1446	10.7004	20.470	255.53
BaO, CO <sub>2</sub>	98.6	4.301	0.1078 Nm. 0.1104 Rg.	0.1091	10.7572	22.924	286.71
PbO, CO <sub>2</sub>	133.8	6.446	0.0860 Rg. 0.0814 Nm. 0.0818 Hm.	0.0830	11.1054	20.601	259.20
BaO, SO <sub>3</sub>	116.6	4.323	0.1088 Nm. 0.1128 Rg.	0.1108	12.9192	26.971	337.55
SrO, SO <sub>3</sub>	92.	3.770	0.1356 Nm. 0.1428 Rg.	0.1392	12.8064	24.403	305.30
PbO, SO <sub>3</sub>	151.8	6.233	0.0872 Rg. 0.0848 Nm.	0.0860	13.0548	24.354	304.14

\* Dolomite.

Formulae.	Atomic Weight.	Specific Gravity.	Specific Heat.	Mean Specific Heat.	Atomic Heat.	Atomic Volume.	Volume according to Kopp.
BaO, NO <sub>5</sub>	130.6	3.050	0.1334 Hm. 0.1523 Rg.	0.1428	18.6496	42.819	536.75
SrO, NO <sub>5</sub>	106.	2.948	0.1683 Hm.	...	17.8398	35.956	449.41
PbO, NO <sub>5</sub>	165.5	4.584	...	...	19.2*	36.103	452.58
Ba Cl	104.	3.782	0.0780 Hm. 0.0896 Rg.	0.0838	8.7152	27.498	343.75
Sr Cl	79.4	2.803	0.0972 Hm. 0.1199 Rg.	0.1085	8.6149	28.326	353.18
Pb Cl	139.2	5.574	0.0664 Rg.	...	9.2428	24.973	312.24
Ca Cl	55.9	2.127	0.1642 Rg.	...	9.1787	26.281	...
KO, NO <sub>5</sub>	101.2	2.030	0.2690 Av. 0.2387 Rg.	0.2538	25.6845	49.852	624.71
NH <sub>4</sub> O, NO <sub>5</sub>	80.	1.643	...	...	30.4*	48.691	612.00
NaO, NO <sub>5</sub>	85.2	2.185	0.2400 Av. 0.2782 Rg.	0.2591	22.0753	38.993	489.08
AgO, NO <sub>5</sub>	170.1	4.355	0.1435 Rg.	...	24.109	39.058	488.79
Na Cl	58.6	2.114	0.2210 Av. 0.2300 Dl. 0.2140 Rg.	0.2216	12.9857	27.719	347.09
Ag Cl	143.5	5.363	0.0844 Hm. 0.0911 Rg.	0.0877	11.7849	26.757	334.81
KO, SO <sub>3</sub>	87.2	2.640	0.1690 Av. 0.1901 Rg.	0.1795	15.6524	33.030	413.25
KO, CrO <sub>3</sub>	99.3	2.652	0.1850 Rg.	...	18.370	37.443	468.33

To the first group belong sulphur, selenium and tellurium, substances closely connected, not only by their own similarity in chemical properties, but also by that of their analogous compounds. Sulphur and selenium, although their atomic weights, and therefore the magnitude of their atoms, differ so much, correspond very closely, nevertheless, in both atomic heat and volume. Hence, probably, the isomorphism of the sulphates and seleniates, sulphurets and seleniurets—a point which I have not been able to verify satisfactorily, in consequence of not being able to find upon record any reliable specific heats for the seleniates and seleniurets, by which they might be compared with the corresponding sulphur salts. The atomic volume of Pb S is 16.592; that of Pb Se, 16.341. The experiments of Mitscherlich show that the sulphates and seleniates crystallize in right, rhombohedral prisms, at a very low temperature; in octohedrons with a square base, at a mean temperature; and in oblique prisms, at a

\* Calculated according to the method laid down by Gmelin.

very elevated temperature. Tellurium associates itself with this class by heat and volume, as well as by chemical properties. Reasons exist for ranking oxygen with these three elements. The probability of such a connection finds some support in the fact that the combining measure of aqueous vapor and sulphuretted hydrogen is two volumes, and that of the oxide, sulphuret and telluret of ethyl, four volumes. An atom of each of the two former substances, probably possesses a heat-sphere of the same size. The calorific envelopes of the atoms of the last three are also equal to each other in extent, but twice as great as those of the former. The relation of the oxides and sulphurets is seen in the subjoined table.

Oxides.	Atomic Heat.	Atomic Volume.	Sulphides.	Atomic Heat.	Atomic Volume.
HgO	5.665827	9.855	HgS	6.00736	14.625
MnO	5.58956	7.568	FeS	5.97080	...
CuO	5.65199	6.297	NiS	5.84273	...
NiO	5.97276	...	CoS	5.70548	...
MgO	5.71320	6.500	ZnS	5.93005	12.286
ZnO	5.98176	7.178	PbS	6.09303	16.592
PbO	5.72192	11.982	SnS	6.27375	...
CaO	5.10150	9.016			
SnO	6.2980	10.044			

Sulphuric and manganic acids are isomorphous. From this is inferred the isomorphism of the elements sulphur and manganese. Hence manganese is regarded as the connecting link between the first three elements in the table, called the sulphur class by Graham, and the next seven, named the magnesian class. Manganese is regarded, therefore, as a sort of transition element, by which one group runs into or is blended with the other,—a good example of the artificiality or unreality of scientific classification in general. For the great plan of nature is, in the main, so uniform, that the gaps which apparently dissociate the different parts are being constantly filled up as new discoveries are made. Now, manganese has an atomic heat of 4.0059, and an atomic volume of 3.466. The first connects it, therefore, with both groups, and the last with the magnesian series. The mean atomic volume of most of the bodies in the second class, is a multiple by three of that of the first; the others bear an equally simple relation. The correspondence of their elements in heat and volume, is of itself sufficient to bring these two classes into one category. Moreover, their more perfectly isomorphous protoxides evince a similar relationship in heat and volume, as shown in the second table. It may be interesting to observe in this connection that ice (HO) and protoxide of zinc, (ZnO) which differ not much in atomic heat, have been seen to assume the same regular, six-sided form. Their complete isomorphism, however, has not yet been established by exact measurement.

	At. Heat.	At. Volume.
HO . . . .	6.480 . . . .	9.8
ZnO . . . .	5.98176 . . . .	7.178

As oxygen, through the resemblance of certain oxides and sulphurets, appears to

rank with sulphur, so the resemblance in their chemical relations between HO and CuO is supposed to connect hydrogen with the group in question. It is curious to observe that the atomic heat and volume of HO tend to confirm the notion of its connection with the magnesian class.

Lime (CaO) probably occupies an intermediate position between this and the barium series, blending them gradually together. This is very well shown in the table of isomorphous salts, in the two groups of carbonates, where carbonate of lime as calc-spar, assimilates, on the one hand, with the corresponding carbonates of magnesia, iron, the mineral dolomite, &c., and on the other, as arragonite, identifies itself with the carbonates of strontia, baryta and lead. The protoxides of barium, strontium, calcium and lead, are nearly related in heat and volume. But the similarity of the barium class to the magnesian is shown through their chlorides, where the correspondence in atomic heat and volume is quite remarkable.

Salts.	Atomic Heat.	Atomic Volume.
BaCl	9.31528	27.513
SrCl	9.52006	28.357
CaCl	9.17878	26.244
MgCl	9.36026	...
MnCl	8.98065	...
ZnCl	9.20577	...
SnCl	9.59198	...
PbCl	9.24427	25.217
HgCl	9.42415	25.714

In the next two groups the numbers for atomic heat are the same throughout; as, with one exception, are those for atomic volume. This is an exception in appearance only, and not in reality, for its volume-number is just about double that of the others, preserving, therefore, a simple multiple relation. This view finds confirmation in the isomorphism of the oxides of tin and titanium, which compounds, as the table shows, are sufficiently identified in heat and volume. Indeed the coincidence is still more positive than at first sight appears. It will be seen that the specific heat obtained by Avogadro for SnO<sub>2</sub> differs so much from the other three observations, that it may very properly be omitted in calculating the mean specific heat of this body. This procedure will give 6.9075 for the atomic heat of the oxide of tin. So the number furnished by Hermann for the specific heat of TiO<sub>2</sub> may, with equal propriety, be rejected in ascertaining the mean specific heat of titanic acid. We thus obtain 6.9417 for the atomic heat of this latter substance. These two numbers may be considered as identical. I may here remark that a similar analysis of the whole table would lead to results still more striking than those indicated. I have preferred, however, to give all the recorded specific heats, with the mean for each elementary and compound substance, from which to calculate the atomic heat, because in this manner is avoided the confusion of so many analogous numbers for any body, and still more because I regard the results obtained in the table as approximations merely to a great general truth or law in nature, which yet remains to be demonstrated by a logical

synthesis of scientific facts. In these investigations it must, for the present, be kept constantly in view, that the numbers obtained by experiment for the specific heat of different bodies, do not accurately express the amount of caloric combined with the ponderable matter of those bodies. The specific heat is only a portion of the whole quantity of combined heat; and, as Regnault has shown in his second memoir,\* the obstacles to be overcome in obtaining the specific heat of any substance, with perfect accuracy, are exceedingly great, if not, indeed, insurmountable with our present appliances.

From the isomorphism of their double chlorides, Dr. Clark is inclined to associate the tin and platinum classes. The relation of these two series in heat and volume lends considerable support to their presumed affinity. According to Breithaupt, CdS is isomorphous with the alloy IrOs. The atomic volume of either iridium or osmium is to that of CdS as 1 : 1½. Palladium, although not generally arranged in this series, appears here to find its natural place.

Tungsten and molybdenum correspond in heat and volume. The tungstates and molybdates are isomorphous, as their agreement in atomic volume sufficiently indicates. I have not been able to find upon record the atomic heat of these salts. Their supposed isomorphism is confirmed by the following comparison :—

	At. Heat.	At. Volume.
WO <sub>3</sub> . . . . .	9.496 . . . . .	22.580
MoO <sub>3</sub> . . . . .	9.533 . . . . .	20.809

The bisulphurets of tin and molybdenum, which present some resemblance in their physical constitution, have atomic heats but little different. The bisulphuret of iron differs very much from these in its characteristics, and we find that its atomic heat is also very different. (Regnault.)

In the metallic state gold and silver are isomorphous. Their relationship in heat and volume is very obvious. I have followed Gmelin in adopting 199 as the atomic weight of gold. If we assign it 99.6, as do some of the chemists, and halve the atomic weight of silver, for the cogent reasons advanced by Regnault, the above relation still holds good. Or, if we reject the suggestion of Regnault, it will be found that in heat and volume silver is the exact multiple by two of gold; so that in either case, the simplicity of relation (which in the present state of our knowledge of these subjects is all that we can contend for) is still preserved. Sodium allies itself with silver, as shown by the resemblance in atomic volume of their carbonates, sulphates, nitrates and chlorides. In all this series, as far as the specific heats have been obtained, the same correspondence in heat and volume is evident.

The atomic volume of sodium, as given in the table, is about one-half that of potassium. These volumes would be equalized by doubling the atomic weight of sodium; and it is interesting here to observe that this alteration has been proposed by Dr. Clarke from theoretical considerations of a different character. The simplicity of relation is therefore evident.

\* Annales de Chim. et de Phys., 3<sup>me</sup> sér., t. 1, p. 200.

It is well known that the potassa and ammonia salts exhibit very complete isomorphism. This, indeed, might be inferred from the comparison of the nitrates of these bases, as shown in the table. Hence it is probable that potassium and ammonium, as has been suspected, are themselves isomorphous, notwithstanding that one atom of nitrogen and four atoms of hydrogen replace one of potassium in combination. I have not the data to compare them, either by heat or volume.

Phosphorus, arsenic, antimony and bismuth, constitute a natural group to which nitrogen is thought to belong. For the first three the atomic heat is about the same; the number for bismuth is about one-half that of the others. The relation between the atomic volumes is not so evident. If we follow the example of many of the European chemists, and halve the atomic weights of phosphorus, arsenic and antimony, a tendency to multiple relations between the atomic volumes will become more evident. This tendency is developed in their isomorphous compounds.

Compounds.	Atomic Heat.	Atomic Volume.
As <sub>2</sub> O <sub>3</sub>	12.68371	26.810
Sb <sub>2</sub> O <sub>3</sub>	13.78377	26.984
Bi <sub>2</sub> O <sub>3</sub>	14.30929	27.976
As <sub>2</sub> S <sub>3</sub>	13.94600	35.606
Sb <sub>2</sub> S <sub>3</sub>	14.87331	37.263
Bi <sub>2</sub> S <sub>3</sub>	15.62921	37.257
As <sub>2</sub> Cl <sub>6</sub>	31.96886	...
P <sub>2</sub> Cl <sub>6</sub>	28.83052	95.034
3PbO, PO <sub>5</sub>	32.463	...
3PbO, AsO <sub>5</sub>	32.804	...

Iodine and bromine are isomorphous throughout their whole combinations. Chlorine in certain respects is naturally associated with them. Their relation in heat and volume is seen below.

Compounds.	Atomic Heat.	Atomic Volume.
KBr	13.312	48.612
KI	13.530	50.322
KCl	12.902	38.955
NaBr.	14.061	...
NaI	12.950	...
NaCl	12.541	28.199
AgBr	13.782	29.355
AgI	14.420	41.699
AgCl.	13.073	26.086
PbBr	9.711	27.481
PbI	9.812	38.166
PbCl	9.244	25.217

The isomorphous and calorific correspondences between the different bodies composing each of the several groups of compounds, are sufficiently obvious to require no comment.

In most of the standard chemical works, the elements have been classified isomorphously, not so much from any proof that they individually present, as from the isomorphism of their compounds. The law promulgated by Mitscherlich naturally leads to such supposition and consequent classification. It must not be forgotten, however, that comparatively few of the elementary bodies are crystallizable, and that, therefore, we are in great measure deprived of the positive and demonstrative proof of the isomorphism of all the elements. Nevertheless, two-thirds of the crystallizable elements belong to the regular system, and are hence isomorphous the one with the other. Of these, however, some crystallize in other forms, under which they are isomorphous with elements belonging to other groups, as the Rhombohedral and Right Prismatic. Hence, from their arrangement into various isomorphous classes, and the resemblance between and apparent correlation of these classes, we fairly, though indirectly, infer, as highly probable, that the chemical elements, under certain favorable conditions, are capable of assuming the same form. Now, the approximation of many of these elements, in atomic heat and volume, certainly seems to confirm the reality of this isomorphism. It will thus be seen that the capacity for heat of elementary atoms is related through isomorphism only. Moreover, it will be observed among compound atoms, that although similarity in chemical constitution is, in general, accompanied by sameness in capacity for heat, yet examples exist of differently constituted bodies also presenting this similarity. This is an important fact and one worthy of close consideration, since it probably explains why one atom in a compound body will replace two or more atoms in another with which it is isomorphous. Thus  $\text{Cu}_2\text{S}$  and  $\text{AgS}$  are isomorphous. Here two atoms of copper replace one of silver, and yet retain the same form. Now the atomic heat of copper is about half that of silver. The atomic heats of the two sulphurets are as follows:—

	At. Heat.	At. Volume.
$\text{Cu}_2\text{S}$	9.647	13.528
$\text{AgS}$	9.258	18.116

Even if we adopt Regnault's suggestion, before alluded to, and write both substances according to the formula  $\text{R}_2\text{S}$ , the numbers for atomic heat will still be nearly the same.

Bisulphuret of iron  $\text{Fe}_2\text{S}_4$  is dimorphous. In the mineral Spirkise it is isomorphous with arsenide of iron  $\text{Fe}_2\text{AsS}_2$ . In the pentagonal dodecahedron of the regular system it is isomorphous with cobalt glance,  $\text{CO}_2\text{AsS}_2$ . Again,  $\text{Cd}_2\text{S}_2$  and  $\text{Ni}_2\text{S}_2$  are each isomorphous with  $\text{Ni}_2\text{As}$ . Thus it would appear that one equivalent of arsenic is isomorphous with two of sulphur. Now the table shows us that the atomic heat of



arsenic is about twice that of sulphur. The atomic heat of  $\text{Fe}_2\text{S}_4$  is 15.60384, of  $\text{Fe}_2\text{AsS}_2$ , 16.35392. The cyanides replace the chlorides, three atoms occupying the space and performing the function of one. The atomic heat of cyanogen is 14.4222, that of chlorine, 14.4627.

We come now to inquire why the atomic heat and volume in many of the isomorphous groups are not absolutely identical. Many bodies called isomorphous are not strictly so. Their corresponding angles sometimes vary several degrees. A variation of  $59'$  has been observed by Mitscherlich in the analogous angles of different specimens of the same salt. In the sulphates of barytes and strontia the angles of the rhombs differ by  $2^\circ 48'$ ; in the carbonates of lime and magnesia by  $2^\circ 36'$ ; and in the sulphates of zinc and magnesia by  $38'$ . Inequalities also exist between the axes of such plesimorphic bodies. Now the interdependence of crystalline condition and atomic volume has been well and beautifully shown by Kopp, as the result of an attentive study of the various classes of plesimorphic and strictly isomorphous compounds. That careful physicist found that variations in the individual angles of a crystal were accompanied by corresponding variations in its atomic volume. But the angular value of a crystal depends upon the proportions between its axes, and these cannot suffer alteration without changing the density, and, consequently, its specific gravity—alterations necessarily preceding variation in atomic volume. Elongation of the principal axis increases the atomic volume; thus, step by step, we are led to the conviction that crystalline form is inseparably connected with, and dependent upon, peculiar axial proportions. Whatever modifies these proportions in a definite manner, must be considered as the ultimate cause of the plesimorphic differences referred to above. In this connection, the observations of Mitscherlich, Fresnel and others, upon the application of heat to crystals, may be studied with much advantage, as they are well calculated to lead to results as positive as they are important. According to these gentlemen, when crystals not belonging to the regular system are heated, their axes expand unequally and change the magnitude of their angles. Crystals of the right prismatic system have their three axes expanded differently. In arragonite, on raising the temperature from  $32^\circ$  to  $212^\circ$ , the inclination of the lateral faces increases by  $2' 46''$ , and that of the terminal faces diminishes by  $5' 29''$ ; gypsum is more expanded by heat in the direction of the principal axis than in that of the lateral axes. In bitter spar, the obtuse angle of the primitive rhombohedron diminishes when the temperature is raised from  $32^\circ$  to  $212^\circ$  by  $4' 6''$ ; in ferruginous bitter spar, by  $3' 29''$ ; in iron spar, containing a considerable quantity of manganese, by  $3' 31''$ ; and in pure iron spar, by  $2' 22''$ . In crystals of the rhombohedral system, the expansion is the same in the directions of the three secondary axes, but different in that of the principal axis.\* But the positive and methodical influence of heat in changing the density, axes and angles, and, therefore, the form

\* Gmelin. Hand-Book of Chemistry, Cavendish Society edition, vol. i. p. 233.

of a crystal, is beautifully and conclusively shown in the following example: Calcareous spar, heated to  $180^{\circ}\text{F.}$ , has its specific gravity decreased in the proportion of  $1 : \frac{1}{1.001961}$ ; its principal axis expanded by 0.001961; and each horizontal axis contracted by 0.00056; in consequence of which the obtuse angles of the primitive rhombohedron diminish, and the acute angles increase by  $8' 34''$ . Now, according to Kopp, when its principal axis = 0.85440, and its obtuse angle =  $105^{\circ}.5'$ , the specific gravity of calc spar is 2.7220. When heated, its specific gravity becomes 2.71675, and its atomic volume passes from 232.36 to 232.80; or, in other words, a modification of form ensues.

The phenomenon of dimorphism presents us with many examples strongly confirmatory of the significant connection, here indicated, between form and capacity for heat. Still more do they conduct us to some positive notions concerning the active agency of caloric in producing crystalline form. "Crystals formed at one particular temperature," says Gmelin, "and then exposed to that temperature at which crystals of a different kind are produced, often lose their transparency, and, without alteration of external form, become changed into an aggregate of small crystals of the latter kind. We may therefore imagine that the atoms of the solid crystal displace one another in such a manner as to bring about the particular arrangement which they are disposed to assume at the altered temperature, the new arrangement belonging to a different crystalline system."\* Carbon, as found in the diamond, which belongs to the regular system, has a different atomic heat from carbon as found in rhombohedral graphite. In fact, all the varieties of carbon differ in the same respect, as shown in the following table:

Varieties of Carbon.	Specific Heat.	Atomic Heat.	Atomic Volume.
<i>Diamond.</i>	0.1192 D.M. 0.1469 Rg.	0.8814	1.690
<i>Graphite:</i>			
Natural,	0.2019 Rg.	1.2114	
Artificial,	0.1970 Rg.	1.1820	2.857
<i>Coke:</i>			
3 varieties,	0.2036 Rg. 0.2017 Rg. 0.2031 Rg.	1.2216 1.2102 1.2186	3.333
<i>Charcoal:</i>			
Strongly ignited,	0.2415 Rg.		
"                    "	0.2009 D.M.	1.3272	
Moderately heated,	0.2964 D.M.	1.7784	
From Sugar,	0.1592 Rg.	0.8552	
"    Ol. Terebinth,	0.1801 Rg.	1.0806	
Lamp Black,	0.2570 Av.	1.5420	
Animal,	0.2608 Rg.	1.5648	

Carbon thus furnishes us with an excellent example of the connection between the calorific capacity of a body and its degree of aggregation.

\* Gmelin. Op. cit., vol. i. p. 98.

If sulphur be melted and allowed to solidify at  $230^{\circ}\text{F.}$ , it assumes the form of an oblique rhombic prism; if it be made to crystallize from its solution in bisulphuret of carbon or oil of turpentine, at a temperature under  $100^{\circ}$ , it appears in the shape of octohedrons with rhombic bases. According to Graham, the crystals of sulphur produced at the higher of two temperatures, become opaque when kept for some days in the air, and pass spontaneously into the other form, in consequence of a new arrangement of atoms; at the same time their transparency is destroyed, because a mass of crystalline particles takes the place of one crystal, thus causing the light to be refracted in various directions. The crystals produced at the lower temperature are disintegrated and changed into the other form by a moderate heat.

As in the case of carbon, the varieties of sulphur differ in atomic heat.\*

If chloride of calcium and carbonate of ammonia be mixed together, and the solution brought to a temperature of  $50^{\circ}\text{F.}$ , the precipitating carbonate of lime will take the form of rhombohedric crystals, as in calc-spar; if the solution be kept at  $150^{\circ}$ , the crystals appear as cubes, as in arragonite. If these cubic crystals are allowed to remain in the liquid, while the latter is gradually cooling, they are slowly but completely converted into calc spar.†

According to Fownes, green sulphate of iron crystallizes in two different forms, and with two different proportions of water, according to the temperature at which the salt separates from the solution.‡

A prism of arragonite, exposed to the flame of a spirit-lamp, decrepitates at a low red heat, and breaks up into numerous minute rhombic grains of calc spar. Melted chalk, on cooling into marble, exhibits a rhombohedral structure. From these facts it appears, that while a low temperature gives to  $\text{CaO}$ ,  $\text{CO}_2$  the form of calc-spar, a higher temperature is necessary to produce arragonite,—which latter is indeed formed only between very narrow thermometric limits. Below are the atomic heats of different varieties of carbonate of lime.

$\text{CaO}$ , $\text{CO}_2$	Atomic Heat.
Calc-spar, . . . . .	10.0747
Artificial, . . . . .	10.2515
Arragonite, . . . . .	10.3575
Iceland spar, . . . . .	10.5343
Chalk, . . . . .	10.8474
Statuary marble, . . . . .	10.8979

Carbonate of strontia precipitates in an indeterminate form, when chloride of strontium is decomposed by carbonate of ammonia in the cold. When heated, it takes the form of arragonite. But the chlorides of barium and lead, when mixed with carbonate of ammonia in the cold, respectively precipitate  $\text{PbO}$ ,  $\text{CO}_2$  and  $\text{BaO}$ ,  $\text{CO}_2$  in the

\* Regnault. Op. cit., pp. 206, 207.

† Rose. Philosoph. Mag., 3d ser., vol. xii. p. 465.

‡ Elements of Chemistry, p. 176.

form of arragonite. Now the latter carbonates have a somewhat higher atomic heat than  $\text{SrO}$ ,  $\text{CO}_2$ .

If hot, concentrated caustic potash be saturated with protoxide of lead, the latter separates in the shape of rhombic octohedrons having a yellow color; as the solution cools, however, red, crystalline scales are deposited on the first. If the red crystals be heated, they take the first form and also the yellow color.\*

Anatase and rutile, two forms of oxide of titanium, though both belonging to the square prismatic system, have incompatible angles, which assign to each a different primitive form. They differ in atomic heat and volume.

Bisulphuret of iron, as common iron-pyrites, belongs to the regular system; as white iron-pyrites, to the right prismatic system,—the latter being of a paler yellow color and much softer. Breithaupt thinks that the former has been formed at a higher temperature than the latter. The atomic heat of the common variety is 7.5480; of the white variety, 7.8854.

Sulphate of nickel ( $\text{NiO}$ ,  $\text{SO}_3\cdot 7\text{Aq.}$ ) is trimorphous. It crystallizes below  $59^\circ \text{F.}$  in right rhombic prisms; between  $59^\circ$  and  $68^\circ \text{F.}$  in acute octohedrons with square bases; and above  $86^\circ \text{F.}$  in oblique rhombic prisms; also in forms belonging to the right, square and oblique prismatic systems. The right rhombic prisms, after exposure to sunlight for a few days, are found to be composed of square-based octohedrons, often several lines in length. The sulphates of zinc and magnesia exhibit similar phenomena. They assume different forms, according as they are made to crystallize at a high or a low temperature,—manifesting, as Mitscherlich has shown, very peculiar and interesting changes with variation of temperature.†

According to Frankenheim, sal ammoniac, which generally crystallizes in regular octohedrons, appears at higher temperatures to assume forms belonging to the right prismatic system.‡

When the rhombohedrons of  $\text{KO}$ ,  $\text{NO}_3$  are heated considerably above  $100^\circ \text{C.}$ , they change into prismatic crystals. A hot solution of  $\text{KO}$ ,  $\text{NO}_3$  deposits prismatic crystals when slightly cooled; at a temperature of  $14^\circ \text{F.}$ , however, rhombic crystals begin to appear. (Frankenheim.)

Protiodide (red iodide) of mercury sublimes at a low heat, and also separates from solution in square, prismatic tables of a scarlet hue; at a higher temperature, rhombic tables of a sulphur-yellow color are formed. As often as they are heated, the red crystals turn yellow, and again become red as they cool. (Gmelin.)

Examples of this kind attest the strong, controlling influence of temperature upon isomorphism. We see that whether a body shall be isomorphous with a second or a third, is mainly determined by temperature. “Les isomorphismes chimiques d’un

\* Mitscherlich. Jour. Pr. Chem. 19, 451.

† Gmelin.

‡ Jour. Pr. Chem. 16, 3.

même corps peuvent donc changer complètement avec la température.”\* Changes in the form of a body correspond to variations in its combined heat.

Many crystallizable bodies assume a peculiar state of aggregation known as the vitreous condition, which may be considered as a variety or modification of dimorphism. The binarsenate and biphosphate of soda resemble each other strongly in physical and chemical properties. When exposed to the same heat, the first solidifies, on cooling, into a white opaque mass composed of interlaced crystalline fibres, while the second is converted into a transparent, colorless glass. While undergoing these changes, the arseniate discharges sensibly more heat than the phosphate; hence, probably, the glassy condition of the latter salt is due to the retention around its particles of a portion of the heat of fluidity.†

Ordinarily sugar has a granular or crystalline structure. When melted and allowed to cool slowly, it assumes a glassy condition and manifests very different physical properties. If, while still soft and viscid, (as at the temperature of  $100^{\circ}$ ,) it be rapidly drawn out into threads, a large quantity of heat is liberated, and the sugar separates into minute granules of a pearly lustre.

That the vitreous condition is in some manner connected with the amount of heat accumulated around the ultimate particles, is shown by the fact that glass kept soft for a long time, gradually loses its heat and is converted into a substance known as Reaumur's porcelain, in which it assumes different characters. The crystalline and amorphous states of the same body differ to a certain extent in their properties; the former being in general harder, specifically heavier and less soluble than the latter, in which the atoms are placed farther apart than in the first. Graham also affirms that the amorphous condition is accompanied by a larger quantity of combined heat than the crystalline.

Arsenious acid sublimates as a transparent glass with a light, yellow tint. By exposure, the vitreous mass gradually changes into a congeries of small octohedral crystals, and becomes opaque, milk-white, and slightly altered in solubility and density. According to H. Rose, if the vitreous mass be dissolved in hydrochloric acid, each crystal as it separates emits a flash of light. Regnault, in his second memoir, says, “l'acide vitreux (arsenious) devient promptement opaque à la température de  $100^{\circ}$ .” The vitreous acid has an atomic heat of 15.0796; the opaque, 15.2064. Now, Guibourt has shown that the specific gravity of the vitreous acid diminishes during the change to the opaque form, from 3.785 to 3.695; and that the latter dissolves rather more abundantly both in hot and cold water than the transparent. This is an exception to the ordinary cases, for the change from the amorphous to the crystalline form is accompanied generally with increased density and diminished solubility. It is interesting here to observe that the difference in atomic heat, though very small, is

\* Regnault.

† Graham's Elements, p. 151.

in favor of the opaque variety—another departure from the usual rule, the opaque form, having commonly less than the transparent or vitreous.

The limits to which I have assigned this paper, prevent me from here introducing in detail many facts similar to the above. I would, however, especially refer the reader to the first volume of Gmelin's Chemical Hand-Book, where, in the article on Amorphism, have been collected from the writings of Rose, Fuchs, Regnault, Frankenheim, Marchand, Scherer and others, many valuable and instructive examples of the modifying influence of caloric upon the state of aggregation, form and properties of bodies. These constitute but a few of the many examples which a progressive science is daily placing upon record, to be used hereafter for the loftiest purposes of philosophical generalization. They are worthy of, and will amply repay, the closest investigation, since they conduct us to the very threshold of Nature's secret laboratory, promising to lay bare that for which the human mind, through all ages, has so fondly and unceasingly longed—a knowledge of the primary physical cause of all natural phenomena.

Nature annually performs for us, on a grand scale, an experiment at once simple, beautiful and instructive. I allude to the formation of snow crystals. In this process the crystallizing material is the same throughout all the varieties of form, but the accompanying temperature varies. In his excellent work on the Arctic Regions, Scoresby has classified the many forms of snow-flakes observed by him in his voyages to the North, and given a table showing the different temperatures at which different crystals were seen to fall. He refers the varieties of snow crystals, for their cause, to variations in atmospheric temperature. My own observations made during the past winter, lead to the same conclusion. When, after variable weather in the winter season, the cold has set in steadily for several days, gradually condensing the aqueous vapor and obscuring the heavens, the wind constantly blowing from the same point, and the upper atmospheric currents, as shown by the course of the clouds, having the same direction as the lower, I have very generally found that while the thermometer indicates nearly the same reading, the crystals of snow that fall under such circumstances have the same or but slightly differing forms. Any marked change in the height of the mercurial column is very commonly followed by some manifest change in the snow-figures. It is true that very different and unrelated forms are often observed to fall simultaneously; but reasons well known to the climatologist, render it very probable that they have been generated in atmospheric currents or strata differing in temperature. Indeed I suspect that a snow-crystal, by passing through variously heated currents of air, may have its form considerably altered as it descends towards the earth. By holding the partly-closed hand over a crystal, so as to increase the warmth of the surrounding air, I have, on several occasions, noticed very remarkable modifications of form. Mr. James Glaisher also speaks of this phenomenon, in



a communication directed to the Editor of the Illustrated London News, (Feb. 24th, 1855.) He says, "In conclusion, I may be forgiven if I remark, for the benefit of the inexperienced, that the crystal subjected to the warm influence of the proximity of the observer, not unfrequently alters in form before it sensibly begins to melt. I have myself more than once drawn a specimen on its first descent, verified it to my satisfaction, and passed on to others; after the lapse of perhaps a quarter of an hour or more, I have been surprised by witnessing, as I imagined, a new specimen occupying the precise spot of the former. In each case, however, careful observation proved to me that it was no other than the crystal I had already drawn, and that the dissimilarity arose from a general simplification of the figure caused by the subsidence of the groups of prisms surmounting the apex of the rays, the rounding of the edges of those prisms which remained, the subsiding of two or more prisms into one, and the elongation of spiculæ which formerly served as the axes of prisms."

Very peculiar changes may be witnessed by studying the gradual wasting of a snow crystal in consequence of an increasing warmth of the air. Thus I have seen a hexagonal lamella similar to fig. 87 of Scoresby's plates, change into one like fig. 28, then resemble a star, (fig. 13,) and ultimately leave only its three axes as the skeleton or fundamental portion upon which the body of the crystal was erected. These axes finally disappeared, the destruction beginning at their apices and ending at their common centre or junction, thus following an order the reverse of their formation. An exact statement of the amount of heat combined with each variety of snow-crystal would constitute a valuable addition to our present stock of knowledge.

Thus, then, we learn that the particular system or genus in which a body crystallizes, is mainly determined by the temperature at which solidification takes place.

Dimorphism is intimately associated with isomerism. Both phenomena furnish us with instances of the positive and active relation which atomic heat bears to both the form and properties of bodies. Some isomeric substances, though agreeing in ultimate ponderable compositions, differ completely in atomic weight, and every other respect; in others, both the atomic weight and elementary compositions are the same; in others the atomic weights are the same and their molecular arrangement different; but, in all, as far as I can ascertain, their atomic heats are different. Phosphoric and pyrophosphoric acids are alike in composition but dissimilar in properties: the second acid is simply the first in a state of fusion. Racemic and tartaric acids are very similar in properties and chemical relations, and, according to Mitscherlich, isomorphous. When heated, they each form three classes of salts, but are so modified that each, upon uniting with the same base, in the same proportion, produces a different compound. When destructively distilled, both give rise to the same pyr-acid. It is well known, that every organic acid has its corresponding pyr or fire acid.

"When the group of chemical molecules are differently arranged," says Kane, "the



various differences in color, density, solubility and figure which belong to dimorphous bodies are produced; but when the difference of arrangement extends to the chemical constituents of these molecular groups, independent but isomeric bodies are produced.”\* It would thus appear that isomorphism, dimorphism, polymorphism and isomerism are immediately dependent upon a peculiar arrangement of atoms, and of molecules composed of two or more atoms. From the inherent tendency to such arrangement, probably results the binary method of combination in both the organic and inorganic worlds. Now, from all the foregoing facts, we have seen that when bodies agree in form and properties, they also approximate in atomic heat. When bodies assume two or more forms, their chemical properties differ, as do also their atomic heat. Bodies having the same composition, but differing in structure (as in all probability isomeric bodies do), and consequently in properties, differ also in atomic heat.

Throughout this series, a remarkable parallelism is evident, between atomic heat on the one hand, and arrangement of atoms, and forms and properties of bodies on the other. It is very generally true, that bodies having the same form, have also the same properties; and that difference of form is accompanied by corresponding difference in properties. Very probable is it, therefore, that not only form, but also color, specific gravity, solubility, hardness, &c., are all dependent upon certain arrangement of atoms. But the arrangement of particles, necessarily pre-supposes an arranging or motor agent, which constitutes the ultimate physical cause of crystallization. As the attractive force, so grandly displayed in the solar system, must ever be present and in action among the planetary bodies of that system, that they may be retained in their accustomed orbits; so the atoms of a crystal require the continued presence and equal action of the arranging power, to maintain them in that relative position necessary to the preservation of the general form. Hence we infer, that the arranging cause must be a motor power, and always present. Furthermore, if it can be shown that such an agent exists in a crystal, a strictly logical method should prevent us from seeking elsewhere for the cause of peculiar atomic arrangement, and all the physical phenomena manifestly dependent upon it.

Now we have seen that caloric is always associated with the ponderable matter of a crystal, and that it is positively related to crystalline form, and hence, to arrangement of atoms upon which form depends. It only remains to adduce some proof of its efficient activity. The experiments of Fresnel,† Baden Powell,‡ Addams§ and others show conclusively that heat is self-repellant. Moreover, a careful analysis of the entire series of phenomena, which, in the aggregate, constitute the natural history of caloric, tends strongly to establish the fact that heat is a most powerful motor agent. Indeed, the ancients, with very few exceptions, contended (vaguely, however, and un-

\* Elements of Chemistry, p. 231.

† Annales de Chem. et de Phys. 29, 57, 107.

‡ Philosoph. Mag. 18, 415.

§ Gmelin's Chemistry, vol. i. p. 212.

supported by experimental proof,) that caloric was the prime mover and cause of all natural phenomena. A forcible writer of our own time and place, maintains this doctrine with an imposing and comprehensive array of argument.\*

The following brief resumé of facts, connects itself with the question under consideration :—

Cohesion varies inversely with the temperature, generally increasing as the latter diminishes, and vice versa. Heat expands bodies, rendering those that were hard, soft and even liquid and gaseous. This change in bulk and condition, corresponds to an increased separation of atoms. A sufficient reduction of temperature solidifies all bodies. Liquids and gases may be regarded as solid matter, plus a certain amount of caloric, the amount varying with the species of matter. Otherwise, the particular temperatures at which bodies undergo these changes would not be so very different, nor would they always be constant for the same body. Heat is certainly the cause of fluidity, gasfaction and evaporation. The most permanent gases—those which manifest the greatest resistance to being deprived of the gaseous form, by external pressure and cooling—are those in which the most intimate union exists between the ponderable matter and heat. Gases contain more heat than liquids, are more elastic, therefore, and manifest a tendency to expand without limit, if not opposed by external obstacles; liquids contain more heat and are more mobile than solids, which contain least of all the forms of aggregation. Gases by their refinement, superior activity and expansive power, pass through openings impervious to liquids; so liquids escape through openings impassable to solids. Ponderable matter is made to occupy a larger or smaller space, according as it is combined with more or less of the repellant material—caloric.

Dr. Black, whose researches may be considered as constituting the foundation of the science of thermotics, showed, quite clearly, that the structure and properties of solids varied according as their combined heat was increased or diminished. According to this observer, the malleability and ductility of metals depend upon the quantity of latent heat they contain. When hammered, they become red hot in consequence of the disengagement of heat; at the same time, while their density, and consequently specific gravity increase, their malleability diminishes and they become brittle. Malleability is restored by heating. In the first volume of his valuable Hand Book of Chemistry, Gmelin has given numerous and very striking instances, showing that heat imparts to many ponderable bodies particular colors, which vary according to the quantity of heat contained in the bodies. Those metals which increase most in specific heat, when exposed to an elevated temperature, are found to have their rate of expansion also most rapidly increased. According to Dulong and Petit, when the

\*Dr. S. L. Metcalfe, Caloric, its Agencies in the Phenomena of Nature.

increased capacity for heat is about one-tenth, the increase in expansion amounts to one-hundredth. But we cannot conceive of this expansion taking place without the atoms being moved farther apart, thus increasing the volume. Coincidentally with this change, and as a proof of its reality, we find the specific gravity of the metal diminished. Hence it is, that the capacity for heat of any body increases with the temperature; for the arrangement of the atoms at greater distances from each other must necessarily afford more space for the accumulation of caloric around the particles. Thus the specific heat of copper is reduced, by violent hammering, from 0.095 to 0.935; but raised again by ignition, to 0.0949. Lead and tin, on the contrary, which do not increase in specific gravity under the die, likewise suffer no diminution of specific heat by pressure. The specific heat of soft bell-metal, ( $\text{Cu}_{80}\text{Sn}_{20}$ ) which has a density of 8.6843 is 0.0862, while the same metal hardened, in which state its density is 8.5797, has a specific heat of 0.0858. (Regnault.) The more dense a body is, the greater is its specific gravity and the less its specific heat. A beautiful example is given by Regnault in the case of precipitated silver. The specific heat of this substance varies with the degree of condensation, as shown by the following results determined by the method of cooling:—

	20° to 15°	15° to 10°	10° to 5°
Very little pressed, . . . .	0.08535	0.08441	0.08519
More strongly “ . . . .	0.05844	0.05772	0.05781
Still more “ . . . .	0.05749	0.05713	0.05749
Strongly hammered and rubbed, .	0.05634	0.05671	0.05654
More strongly “ “ . . . .	0.05616	0.05624	0.05650

Peroxide of iron and peroxide of nickel when strongly ignited, increase in density and diminish in specific heat. The varieties of carbon present the same result. The interesting experiments of Messrs. Hopkins, Fairbairn and Joule, upon the effects of extreme pressure, demonstrate that the temperature of fusion increases in proportion to the pressure to which the fused mass is subjected. In employing a pressure of about 13,000 lbs. to the square inch, on bleached wax, they found that increase in the temperature of fusion was not less than 30° F., about one-fifth of the whole temperature at which it melts, under the pressure of the atmosphere.\* Such facts, I may say in passing, militate strongly against the generally received, though probably erroneous theory of the exalted calorific condition of the centre of our planet.

But the active agency of caloric in affecting specific gravity, is seen by comparing compound bodies with the elements of which they are composed. Thus hydrogen and chlorine unite, without condensation, to form hydrochloric acid gas. The specific gravity of one volume of hydrogen is 69.26; of one volume of chlorine, 2421.6; and of one volume of hydrochloric acid gas, 1247.4; the mean of the two former numbers. The specific gravity of hydrogen is about 36 times less than that of chlorine; its

\* President Hopkins' Address before the 23d Annual meeting of the British Association.

elastic force, on the contrary, is exceedingly great; while cold alone, or a pressure of but four atmospheres is sufficient to condense chlorine. The expansive power of hydrochloric acid gas, is equal to the pressure of 40 atmospheres, at the temperature of  $50^{\circ}$ . Now the atomic heat of H is 21.2064; of Cl, 14.4627; and of HCl, 28.9263. Four volumes of HCl must contain as many atoms as two volumes of H, or of Cl; or, two volumes of HCl contain as many atoms as one volume of H or Cl. But one volume of H contains half an atom, hence one volume of HCl must contain one-fourth of an atom, which must therefore be surrounded by twice as large a heat-sphere as the half-atom of H. Such facts authorize us to conclude, that chlorine in combining with hydrogen has its specific gravity reduced, in consequence of abstracting from the latter gas an additional quantity of caloric, by which its particles are separated further from each other and made to occupy a larger bulk. This supposition will also account for the change in elasticity. The union of iodine, bromine, cyanogen, &c., with hydrogen is accompanied by a similar reduction in specific gravity, and alteration in physical and chemical properties. When hydrogen unites with sulphur, phosphorus, and arsenic-vapors, and with carbon, in different proportions to form, respectively, sulphuretted, phosphuretted, arseniuretted, and light and heavy carburetted hydrogen gases; with oxygen to form aqueous vapor, and with nitrogen to produce ammonia, the resulting specific gravities of these respective compounds is very much less than the sum of those of their constituent elements. The volume and elastic force of these gases are also altered in a remarkable manner.

According to Graham, the more nearly bodies agree in composition, they are the more likely to act as solvents of each other, or to be miscible in the liquid form.\* But we have seen that in both compound and elementary bodies of the same atomic constitution and of like chemical constitution, the specific heats are in the inverse proportion to the atomic weights. In this connection, I may refer to those numerous and interesting examples of change in the solubility of bodies after being heated, although their composition remains the same. Alumina, binoxide of tin, sesquioxide of chromium, and other metallic peroxides, and certain salts, such as silicates, tungstates, phosphates, antimonates, &c., after exposure to a temperature just below redness, lose their solubility in acids. In its cubic form, the bisulphuret of iron resists the action of both air and water; but in its right rhombic form, when exposed to moist air, it absorbs oxygen with great avidity, and is converted into a crystalline mass of copperas.† Spontaneous ignition often accompanies those changes in solubility, and generally just as the body is passing from the soluble to the insoluble state. “Je crois même que ce changement de chaleur spécifique correspondant à un changement d’agrégation, donne l’explication d’une phénomène bien connu des chimistes et des physiciens, je veux parler de l’incandescence qui se manifeste subitement dans certains

\* Elements, p. 142.

† Kane.

oxides, quand on les soumet á une chaleur graduellement croissante. Il se produit alors un changement dans la disposition moléculaire du corps, un changement d'agregation qui se manifeste dans les caractères chimiques. En effet, la substance qui était facilement soluble dans les acides, avant son incandescence, est devenue très difficilement soluble, quelquefois même insoluble après. L'incandescence s'explique facilement par une diminution subite dans la capacité calorifique du corps, qui dégage instantanément de la substance une quantité considérable de chaleur qui auparavant était latente; cette chaleur, au moment où elle devient libre produit nécessairement une élévation thermométrique qui porte pendant quelques instants la substance á l'incandescence, quand elle n' était encore portée qu' au rouge sombre par la chaleur extérieure.”\*

In the *Annales de Chimie et de Physique*, (1er sér. t. 70, p. 407,) Gay-Lussac has published some observations upon certain bodies whose solubility he shows to be determined by temperature alone. These observations lead, moreover, to the supposition that all spontaneous precipitations are due to differences in temperature.

Many elementary bodies in uniting to form compounds, suffer a contraction in volume. Now, M. Filhol has shown, that in those compounds whose chemical properties are very analogous, the co-efficients of contraction are sensibly the same.† Analogous properties seem to be associated with analogies in calorific condition.

It would be superfluous to adduce other examples of the active character of caloric.

From the laborious and carefully conducted experiments of many eminent physicists, we may infer that in the most, if not all bodies, the combined heat varies to a greater or less extent in different specimens. Examples of this we find in carbon, sulphur, &c. Accompanying this variation, and in all probability caused by it, we find a change in form, condition, physical and chemical properties and the like. Indeed it is difficult to conceive how any change, even the slightest, in the heat of a body, could be unaccompanied by some alteration in the ponderable matter. The extreme sensitiveness of heat or caloric is evinced in every chapter of its endless history. It is very rational to suppose, therefore, that the influence of caloric in moulding ponderable matter into definite forms, must in a certain measure vary with the degree of aggregation of the body, which state of aggregation is indeed in great measure contingent upon the amount of caloric itself. Increased aggregation is generally an indication of diminished calorific capacity. In colcothar and the diamond we have beautiful examples of this fact. In condensing very strongly, a body often completely loses its most characteristic chemical properties. Heat acting upon two dissimilar pieces of metal soldered together, gives rise to electrical phenomena; acting upon water, produces motor effects. From such conspicuous examples we are forced

\* Regnault, *Ann. de Chim. et de Phys.* 3me Sér. i. 188-9.

† *Annales de Chim. et de Phys.*, 3me sér. t. xxi., p. 415.

to conclude that any variation in the ponderable substratum or medium upon which a definite amount of caloric is made to act, or in the attending circumstances by which the body is surrounded, must necessarily produce a variation in calorific effects. Hence the want of absolute identity in the crystalline form of many bodies which are really isomorphous. Hence, too, the discrepancies occasionally met with between the atomic volume of a body and that of the other members of the group to which it belongs. For atomic volume is calculated from relative weight and specific gravity; as the latter two vary, so must the former. Now the specific gravity of a body may vary according as it is adulterated or not with matters lighter or heavier than itself, and having naturally different quantities of heat; or the body itself may, in different states, possess different quantities of combined heat. This view will explain the fortuitous coincidences in form accompanying dissimilarity of properties and composition; and, also, why certain elements manifest isomorphism in their analogous compounds, and yet cannot be shown to be isomorphous in their elementary state. For the mathematico-chemical investigations of Kopp lead us to suppose that the primitive atomic volume of an element suffers a considerable change in its different combinations,—the combining volume bearing in most instances a simple or multiple relation to the primitive. Hence a body may have two or more atomic volumes as well as crystalline forms, which, indeed, we should infer *à priori*.

We know very well that a certain elevation of temperature may so affect the molecular structure of a body as to destroy its identity or individuality,—changing its form, color, properties, &c. This molecular change is nearly always accompanied by a simple multiple change in the equivalent of a body, and of course in the atomic volume. It seems very probable, therefore, that the different forms which certain elementary bodies are known to assume, are intimately connected with diversity of equivalent volume. We may suppose that sulphur has a larger and more intricate volume when it takes the complex form of bisulphate of potassa, than in its ordinary simple form. So, likewise, we may suppose that when one equivalent of chlorine replaces one of cyanogen, or two of manganese in combination, it must have a varying volume, and consequently a varying form, in compound bodies. According to Graham, the tendency of discovery is to bring all the elements into one class, either as isomorphous, atom to atom, or with the relation to the others which sodium, chlorine and arsenic exhibit. In this connection, the sameness of atomic heat of the elements, the similarity of many of the atomic volumes, and the simple relationship of the others, as shown in the table, are significant facts.

If we ignore the materiality of heat, and deny that it is as essential to the composition of bodies as ponderable matter itself, the changes in form, properties, &c., which these bodies undergo, are without explanation. If, on the contrary, we follow the evidence of our senses, and acknowledge the substantiality of caloric and the extent

and dignity of its influence upon the self-inert bases with which it is combined, we open a channel for the hopeful investigation of cause and effect. Changes in the properties of things must be preceded by compositional and structural changes, either of their ponderable or imponderable element, or of both, just as in the animate world organic derangement is the invariable antecedent to functional disturbance. If caloric be merely a property or quality of matter, it cannot possess that self-active and causative power which a careful analysis of its history warrants us in assigning to it. If it be a substantive entity, we can readily understand the remarkable constancy and mathematical precision of its effects; and we can understand, furthermore, how its presence or absence in certain quantities can produce those structural or molecular alterations which manifest themselves externally in variations of form, specific gravity, color, solubility, &c. The estimation of the absolute amount of heat combined with bodies in their different states of aggregation, is one of the most difficult problems in physical science;—and one of the most important, since upon its solution depends the explanation of many unexplained and apparently inexplicable phenomena. However, if we bring together the few reliable observations that have been made in this channel, (especially those concerning the relation between the calorific condition and refractive power of substances,) and the numerous collateral facts which are scattered throughout the literature of physics, we will have material sufficient to begin already the work of cautious and satisfactory generalization.

The following conclusions, as being more or less probable, seem to flow naturally from the foregoing facts and arguments:—

1. That no invariable connection exists between the form and ponderable atomic constitution of a body.
2. That form is immediately dependent upon peculiar axial proportions, which are themselves the results of a certain molecular arrangement.
3. That the arrangement and disarrangement of atoms implies a motor agent; while the definite and constant relation between changes in aggregation and variations in form, implies the materiality of this agent and its continued presence, whether in the same or varying quantities.
4. That this agent has periods of action and periods of rest.
5. That caloric is a positive material entity—an essential element in all bodies, always present in different proportions.
6. That caloric is self-repellant and endowed with great physical power.
7. That crystalline form is the visible representative of atomic volume.
8. That isomorphous bodies have sensibly the same atomic heat and the same atomic volume.
9. That in elementary and compound isomorphous groups, the numbers indicating atomic heat and volume are simply related.



10. That two or more atoms of one element may replace one of another, and retain the same figure; and vice versa; hence, equal numbers of atoms are not essential to isomorphism.

11. That similarity of constitution is generally, though not always, accompanied by sameness of combined heat.

12. That at certain temperatures, the elements may all be made to assume the same form.

13. That variation in the atomic heat of a body is accompanied by variation in its form.

14. That atomic heat is the cause of isomorphism and polymorphism,—consequently of crystalline form in general.

Is caloric, through its affinity for, and active influence upon ponderable matter, the primary physical cause of all crystallization?

ART. XI.—*Contributions towards a knowledge of the MARINE INVERTEBRATE FAUNA,  
of the coasts of Rhode Island and New Jersey.*

By JOSEPH LEIDY, M. D.

The present communication consists of notices and descriptions of invertebrate animals observed during a visit of two weeks, the last August, to Joseph P. Hazard, Esq., on Point Judith, at the entrance of Naragansette Bay, Rhode Island; and of other invertebrate animals collected by Samuel Ashmead, Esq., or myself, in short visits to Absecom Beach, in the vicinity of Atlantic City, New Jersey, and to Beesley's Point, at the mouth of Great Egg Harbor, New Jersey.

PORIFERA.

1. *GRANTIA CILITIA*, Flemming. Sponge elliptical, with a single terminal orifice surrounded with a crown of spiculæ. Color yellowish white; length from two lines to three-fourths of an inch. Point Judith; attached to corallines, mytili, &c.

2. *GRANTIA BOTRYOIDES*, Flemming. Sponge branching irregularly; branches ovate or cylindroid, tubular, with a single terminal aperture. Structural spiculæ trident. Point Judith; with the preceding species.

POLYPI.

3. *CLAVA MULTICORNIS*, Johnston. (Pl. XI. figs. 33, 34.) Polypidom a very short, thin tube of attachment. Polype clavate, with the dilated portion roseate, the remaining portions translucent whitish. Tentaculæ up to twenty. Ova attached in clusters by means of a pedicle below the tentaculæ. Length of polypes up to two lines. Point Judith; in shaded pools between tides, attached to barnacles, the rocks, &c.

Although I found numerous individuals of this polype, I saw none greater than the measurement above given; whereas, the european *Clava multicornis* is stated to exceed half an inch in length. If this is a constant difference, most probably others will be found on comparison sufficient to characterise the american *Clava* as a distinct species. In all the specimens examined I observed a polypidom in the form of a small cup enclosing the basis of attachment, as seen in figures 33, 34.

4. *HYDRACTINIA ECHINATA*, Johnston. (Pl. XI. fig. 35.) Polypidom crustaceous; brown, furnished with simple and compound spines. Polypes long clavate, translucent white; with the head obtuse and furnished with an alternating circle of from six to eighteen cylindrical tentaculæ. Ovigerous polypes smaller than the others, sur-

rounded with a many-lobed head, and having attached to the sides numerous ovigerous capsules, of various sizes, containing from one to five ova. Length of polypes up to one-fourth of an inch. Abundant at Point Judith and at Beesley's Point, investing the shells occupied by the hermit crabs.

EUCORYNE, Leidy. Polypidom, a rooted, branching, corneous tube with a soft axis. Polypes terminating the branches of the polypidom, non-retractile, clavate, furnished with a circle of long, cylindrical tentaculæ, and one or more circles of short tentaculæ with globular tips.

5. EUCORYNE ELEGANS, Leidy. (Pl. X. figs. 1-5.) Polypidom alternately branching, adhering by a coarse reticular root, and growing in profuse branches three or four inches in length; trunk and branches shining black, and annulated at their origin; branchlets yellow, and annulated at their origin and termination. Polypes up to three-fourths of a line long, clavate, translucent white, with the dilated portion encircled with two red bands. Tentaculæ colorless, in two or three circles: first or basal circle twelve in number, filiform, as long or longer than the body; second and third circles of six in each, cylindrical and ending in globular extremities. Quite abundant at Point Judith, adhering to corallines, and other fuci, mytili, &c., below low tide.

Gærtner,\* Van Beneden,† Hassal,‡ and Johnston§ represent *Coryne* as having the tentaculæ terminating in globular extremities and irregularly distributed, while *Eudendrium* is represented as possessing only a circle of filiform tentaculæ. Such being the case, the polype, above described, would characterise a genus intermediate to *Coryne* and *Eudendrium*. Gosse|| has, however, represented two polypes, which he calls *Coryne cerberus* and *Coryne stauridiai*, each having a circle of simply filiform tentaculæ, and a second of those with globular tips. As an examination of *Eucoryne elegans* shows the two kinds of tentaculæ to have a different arrangement in structure, the two species just named either do not belong to the genus *Coryne*, or all the species of the latter possess filiform tentaculæ, and others with globular tips, which I suspect actually to be the case, when the genus *Eucoryne* would cease to exist.

*Eucoryne elegans* is an exceedingly beautiful object, on account of the profuseness of its developement, its graceful branching, and varied coloring. I observed many bunches four inches in length, but the main branches do not measure more than three inches; the addition of length in the branches, being due to the successive origin of the latter from stems of corallines, or other elevated objects of attachment.

The root of the polypidom is a coarse, tortuous, black fibre, reticulated upon the object of attachment. Sometimes an ascidia is imprisoned by the net-work, but more frequently it embraces the stems of corallines, or entangles masses of minute mytili.

\* Pallas, *Spicilegia Zoologica*.

† Rech. sur l'embryol. des Tubulaires.

‡ Ann. and Mag. of Nat. Hist. vol. vii.

§ A History of the British Zoophytes.

|| A Naturalist's Rambles on the Devonshire Coast, pl. xiv. figs. 4-6; pl. xvi. figs. 1-5.

The principle trunks of the polypidom are nearly straight, and they give off alternating branches, provided with from one to half a dozen branchlets. The trunks are black, and are annulated at their commencement, for a short distance after giving off the branches, and at their termination. The branches have the same color and character of annulation as the parent trunks. The branchlets are ochre-yellow, and annulated at their commencement and termination, or occasionally throughout; and frequently they give off secondary branchlets.

The polypes have the familiar form of the nine-pin, and are translucent white, with two purplish red bands encircling the body at the base of the first two circles of tentaculæ. The stomach of the animal is pink, and is visible through the translucent parietes of the body, between the red bands. The head of the polypes is conical, but in the expansion of the mouth is frequently observed to assume a cup shape.

At the base of the polypes there is situated a radiating circle of twelve narrow, cylindrical tentaculæ, about one line in length, and capable of retraction, inflection, or complete reflection. The neck of the polypes is surrounded by two circles, each of six, comparatively short, cylindrical tentaculæ, with large globular tips.

The long tentaculæ of *Eucoryne elegans* are composed of an axis of large, nucleated cells, surrounded with a delicate muscular sheath, and enveloped in a thin, ciliated epithelium. Beneath these tentaculæ, extending their entire length, and enveloping the tips, there is a stratum of nettling cells. The short tentaculæ have the same structure as the others, except that the nettling cells are accumulated entirely at their extremities, and thus give to these their characteristic globular form.

The nettling cells of *Eucoryne* vary in size, and present the same structure as the principal ones of the fresh water Hydræ. When the cells are entire they appear as oval capsules containing at their fundus a hemispherical mass of matter, which in some instances has appeared to me to consist of a coiled thread, as represented in figure 6, plate X. Above this mass or coil is a narrow oval capsule, within which is a style, the point of which slightly projects from the summit of the nettling cell. When the latter has emitted its thread, it appears partially collapsed, and from its summit projects an irregular cone with four barb-like processes at the sides, and the thread protruded from the apex, as represented in figures 5, 7.

As in other compound polypes the soft structure of the animals is continued as an axis throughout the polypidom. This axis contains numerous nettling cells, as large and as well developed as those of the tentaculæ. What can be their office in this position?

*Eucoryne elegans* produces medusa-like buds, in numbers of one to four, situated just above the position of the first circle of tentaculæ. Very frequently a pair of these buds become fully developed at the same time, and then appear larger than the parent.

They are attached by a narrow pedicle, are oval in form, and white in color, with four longitudinal bands of purplish red. They have four short, conical tentaculæ and measure about half a line in length by one-third of a line in breadth.

In one instance, I found a small bunch of *Eucoryne elegans*, in which the polypes had only two circles of tentaculæ: the long cylindrical ones and a circle of the short ones.

Since writing the foregoing, Mr. Ashmead has given to me several dried specimens of *Eucoryne elegans*, from Great Egg Harbor. The bunches are not so profuse as those of Point Judith, but one of them has a branch six inches in length.

6. *LAOMEDEA GELATINOSA*, Lamouroux. Small polypidoms attached to *Mytilus edulis*, *Laminaria saccharina*, the rocks, &c. Point Judith.

7. *LAOMEDEA DICHOTOMA*, Lamouroux. (Pl. XI. fig. 36.) Polypidom very much branched; branches alternate, annulated at their commencement, the larger ones brown, the smaller ones light-yellow; branchlets annulated throughout, or at their commencement and termination, from one to three times the length of the polype cells; the latter campanulate, with an even margin. Ovarian cells axillary, pedicled, two or three times the length of the polype cells, urn-shaped, with the pedicles annulated. Found abundantly, growing in profuse bunches, three inches in length, attached to a submerged wreck on Absecom Beach. Specimens obtained by Mr. Ashmead.

The netting cells of the tentaculæ of *Laomedea* are numerous, and are arranged in circles. They are elliptical in form, often curved, and minute; measuring from .0067 mm. to .0089 mm. long by .0022 mm. broad; and they contain a central style extending from one pole of the cell half through its length. These cells, of which two are represented in figure 8, plate X, I saw at no time emitting threads.

8. *CAMPANULARIA VOLUBILIS*, Lamarck. Point Judith.

9. *CAMPANULARIA DUMOSA*, Flemming. Point Judith. I found small specimens of what I suspect to be this and the preceding species, but had not the opportunity of carefully examining their characters.

10. *SERTULARIA*. Polypidoms, with opposite, tubular cells, the mouth divergent, growing to about three-fourths of an inch in length, are very abundant at Point Judith, attached to the roots of *Fucus vesiculosus* and *F. nodosus*, to the surface of the rocks beneath these fuci, and to mytili, but I did not ascertain the species to which they belong.

11. *SERTULARIA CUPRESSINA*, Lin. Found abundantly, thrown up on Absecom Beach. Some of the bunches measure six inches in length.

12. *ASTRANGIA ASTRÆFORMIS*, M. Ed. et Haime, An. des Sc. Nat. 1849, 181; *Astrangia Danæ*, Agassiz, (non M. Ed. et Haime), Proc. Amer. Assoc. 1850, 69. Polypidom encrusting, flat or lobed, or pedicled and lobed. Polype cells short, approximate, fused together at their bases, cylindrical when free, subpolygonal when crowded, externally slightly costate. Calices infundibular. Columella slightly developed. Partitions up to thirty-five in number, slightly exserted, narrow, with their margin oblique and serrated and their sides denticulated. Polypes cylindrical, projecting up to half an inch in length, translucent white, brown, red, or green; tentaculæ colorless, twenty-four in number, elongated conical, with rounded tips, situated in an alternating circle; mouth oval, situated at the summit of a conical proboscis. Coral masses up to two inches in diameter. Point Judith. Found attached to rocks just below low tide.

The polypidom of *Astrangia astræformis* was first described by Milne Edwards and Haime, in the Annales des Sciences Naturelles for 1849. The living coral was first discovered by Agassiz who dredged it from a depth of nine fathoms off Gay Head in Martha's Vineyard Sound.\* At Point Judith I observed it in position attached to the rocks a little distance below the lowest tide mark. It is especially interesting from the fact that it is the only coral which has been discovered on the eastern shore of the United States. Dead specimens have long been known, and the cabinet of our Academy contains a number of them, among which is one attached to a fragment of a *Fulgur*, from the coast of South Carolina.

Finding the living *A. astræformis* afforded me an opportunity of examining its filiferous capsules. These are especially abundant in the tentaculæ, and in certain white cords of the interior of the body. The function of the cords just mentioned is yet unknown. I frequently observed them extruded from wounds of the body of *A. astræformis*. When detached they will spontaneously roll into a close coil; and are composed of filiferous capsules arranged in a radiant manner around a central cellular axis, enveloped in a delicate, actively vibrating ciliated epithelium.

The filiferous capsules of *A. astræformis* are of two principal varieties. The first variety consists of oval, or ovoidal cells, about .05 mm. long by .0155 mm. broad, containing a spirally wound thread, as represented in figures 11, 12, plate X. The second variety consists of smaller cells; those of the tentaculæ measuring about .045 mm. by .0067 mm., and those of the white cords .03 mm. by .0112 mm.; and they contain besides a spirally wound thread, a style extending from one pole to about the centre of the cells, as represented in figures 9, 10.

Both kinds of filiferous capsules, under certain circumstances not readily explained, eject their contained threads with an astonishing degree of rapidity, and in so doing the threads are absolutely turned inside out, as was first noticed by Agassiz,† and sub-

\* Proc. Am. Assoc. 1850, 69.

† Proc. Am. Assoc. 1850.

sequently by Gosse,\* and remain attached to the emptied cells as long extended tubes. From the smaller cells the style is also extruded, and then appears as a more expanded portion of the thread, with which it is continuous at one end and with the capsule at the other, as seen in figures 15, 16. An attentive examination of the extruded thread exhibits a more complicated structure than would have been suspected, and as remarked by Agassiz, who first detected the peculiar arrangement, its exact character is exceedingly difficult to ascertain and requires the utmost power of the microscope to analyze. In the case of the larger capsules a spiral arrangement is readily distinguishable, extending the entire length of the extruded thread. This arrangement in some instances appeared to me to depend upon minute ciliæ, which project at right angles from the thread, and apparently pursue a spiral course, as described by Agassiz, and as represented in figure 13; but in other instances, it appeared to me as if the thread during its eversion from the capsule, assumed a spiral course within the portion preceding it, and that the thread externally was encircled at regular intervals with non-vibrating ciliæ, as represented in figure 14.

In the case of the smaller capsules the extruded style appears as a tube much dilated beyond its original calibre, narrowed at the extremities, and longer than the cell which contained it, so that it appears to have been folded within itself. From the distal extremity of the stylous tube projects the everted thread, which at times appeared simple, but at other times appeared to possess a spiral arrangement, like the coarser thread of the larger capsules. The tube derived from the style also presents a spiral arrangement, apparently dependent upon long ciliæ pursuing a spiral course as represented in figure 16, or upon a twisting in the tube as represented in figure 15.

13. *ACTINIA MARGINATA*, Lesueur. Body when contracted, in the form of the segment of a large sphere; when expanded, cylindrical; brown in color with longitudinal bands of brighter brown. Tentacular disk deeply folded, translucent brown. Tentacles very numerous, short, elongated conical, from one-sixth to half an inch in length, brown tipped with white, sometimes with a median ring of white, and not unfrequently the white altogether absent. Mouth nearly circular, surrounded with an irregularly lobate, bright orange or reddish brown lip.

This species is abundant at Point Judith. In one position, beneath an overhanging rock, a short distance from Mr. Hazard's residence, I observed a group in the highest state of development. Some of the individuals measured four inches across the tentacular disk.

Var. *ambrea*. Attached to fuci I frequently observed small specimens of an *Actinia*, two or three lines in diameter, and of a translucent ambreous appearance, which I suspected to be the young of *A. marginata*.

\* The Devonshire Coast.



Var. *salmonea*. I found two specimens of an anemone of the same form as that of *Actinia marginata*, about an inch in diameter, and of a bright salmon color, which I suppose to be only a variety of the latter species. It was attached to large mytili, appeared to be more active than the undoubted *A. marginata*, and when irritated ejected jets of water from large pores of the body, a phenomenon I did not observe in the more ordinary variety.

The filiferous capsules of *Actinia marginata* are numerous in the tentaculæ, but especially so in the white cords of the interior of the body. (Pl. X, figs. 17, 18). They are elliptical in form, and measure about the .06 mm. in length by the .004 mm. in breadth; and they contain a spirally coiled thread and a style extending from one pole about two-thirds through the centre. The ejected contents of the capsules present two different forms. In the one case the style assumes the appearance of a spindle-shaped tube, several times its original length, apparently having the extruded thread of the capsule coiled within it and having on its exterior long ciliary appendages, as represented in figure 21. In the other case the extruded style assumes the appearance of a long narrow tube, apparently with the projected thread partly coiled within it and partly everted from its distal extremity as represented in figures 19, 20.

14. *ACTINIA NEGLECTA*, Leidy. Body when closed, obpyriform, or shortly cylindrical; when expanded, cylindrical, about an inch in length by one fourth of an inch in breadth, smooth, translucent olive green. Mouth elliptical, with the lip composed of six greenish white lobes. Tentacles numerous, up to half an inch in length, brighter olive green than the body. A single specimen was found in the mud of a sound, in the vicinity of Atlantic City.

#### POLYZOA.

15. *MEMBRANIPORA PILOSA*, Johnston. The stellate variety is very abundant at Point Judith, encrusting the ruffled borders of *Laminaria saccharina*. It is also found encrusting *Chondrus crispus*, the shells of *Mytilus edulis*, etc. In all the specimens I observed, the cells possessed four lateral spines and a posterior spine, and this in no case was developed to the dimensions which would give it the name of a bristle.

16. *ESCHARINA LINEATA*, Leidy; *Flustra lineata*, Lin. (Pl. X. fig. 22.) Polypidom crustaceous, circular. Polype cells oblong oval; mouths large, with about ten inclined spines on each side. Found by Mr. Ashmead, on pieces of anthracite coal from a wreck, at Beesley's Point.

17. *ESCHARINA PEDIOSTOMA*, Leidy; *Lepralia pediosoma*, Hassal. (Pl. X. fig. 23.) Polype cells, six-sided oval, closely punctured; mouth subterminal, quadrate with rounded angles, and slightly constricted at the sides. On shells. Beesley's Point. Obtained by Mr. Ashmead.

18. *ESCHARINA VARIABILIS*, Leidy. (Pl. XI. fig. 37.) Polypidom encrusting, spreading in circles; simple or lobate. Polype-cells exceedingly variable: square, oblong square, tubular, oval, ovoid, or flask-formed; arranged alternately, semi-alternately, in advancing series, or opposite; more or less convex, or flat, or with a large spheroidal dilatation in advance of the mouth; usually procumbent, occasionally semi-imbricated, and rarely vertical; when young glistening white, thin, and covered with perforated mamillæ; when old dull white, thick, and reticulated. Mouth terminally lateral or median, usually to the left, circular, with an elevated border, emarginated inferiorly or laterally, with or without a short tubercle below the emargination. Anal aperture triangular, oblique, elevated, protected by a triangular corneous valve, usually situated to the right of the mouth, occasionally to the left, more rarely beneath, sometimes conjoined with the mouth, and not unfrequently entirely absent. Polypes brownish orange color. Found at Point Judith encrusting rocks and shells; obtained by Mr. S. Ashmead at Great Egg Harbor, N. J., encrusting oyster shells, serpulæ, &c.

This species of *Escharina* may have been already described under half a dozen names, but I found it no easy task to determine which they are. The *Celleporidæ* are subject to great variety of form, and require much study before the true species can be ascertained.

19. *CELLULARIA FASTIGIATA*, Blumenb. Polypidom branching dichotomously. Polype cells in alternating pairs, elongated conoidal, with a short spine supero-externally; mouth large, elliptical, with an entire margin. Found in small bunches attached to fuci. Obtained by Mr. Ashmead, in Great Egg Harbor.

20. *ALCYONIDIUM? PELLUCIDUM*, Leidy. (Pl. X. fig. 24.) Polypidom translucent white, attached by narrow fasciculated bases, which are extended in a procumbent manner and then expand into wedge-shaped masses, upon the free, flat surfaces of which the polypes are clustered. Polypes with bright orange colored tentaculæ. Attached to rocks, mytili, sponges, &c., at Point Judith; abundant.

The masses of *A. pellucidum* from the white, fasciculated points of attachment to the broad free surfaces are up to an inch in thickness. Although I preserved a number of specimens in fresh sea-water for some days, I could not induce the polypes, if they were such, to protrude from their cells, and I only had the opportunity of examining them in their retracted condition as represented in figure 24, plate X.

21. *BOWERBANKIA GRACILIS*, Leidy. (Pl. XI. fig. 38.) Polypidom delicate, creeping, branching, white. Cells cylindrical, erect, about one-third of a line in length, without appendages at their orifice, the margin of which is retractile with the inhabitant of the cell. Polype provided with eight ciliated arms. Intestine with a strong gizzard. Point Judith.

This species differs from *Bowerbankia densa* in having a less number of tentaculæ and in having no spines to the cells. From *Furella* our polype differs in possessing a strong gizzard. The animal corresponds in its form very closely with the figure given by Hassal in the seventh volume of the An. and Mag. of Nat. History for 1841, Pl. viii. fig. 4.

22. *PEDICELLINA AMERICANA*, Leidy. (Pl. X. fig. 25.) Polypidom delicate, creeping, white, with erect branches about one-third of a line in length, smooth and without abrupt dilatations. Polype campanulate, white, with a wide, crenated border marked with fine concentric lines. Tentaculæ cylindrical, twelve or more in number. Found attached to the roots of *Laminaria saccharina*, at Point Judith.

23. *VALKERIA PUSTULOSA*, Johnston. Polypidom growing in profuse, wide spreading bunches up to two or more inches from the root of attachment. Stems flexuose; alternately branching at the flexures. Cells oval, arranged in semi-spiral clusters up to a half a line in length and situated about the same distance apart. Found by Mr. Samuel Ashmead, in Great Egg Harbor, N. J.

#### DENDROCÆLA.

24. *MONOCELIS AGILIS*, Leidy. Body elongated elliptical, anteriorly and posteriorly subacute, black or fuliginous. Eye brown. Length one line, breadth one-eighth of a line. Found actively creeping on *Mytilus edulis*. Point Judith.

25. *PLANARIA FREQUENS*, Leidy. Body spatulate, posteriorly convex, anteriorly narrowed; head auriculate. Eyes two, reniform, distant. Color above black, beneath grey. Length one to two lines, by one-sixth to two-fifths of a line in breadth. A small, quite active, and remarkably abundant species, found beneath stones, near high tide mark. Point Judith.

26. *NEMERTES SOCIALIS*, Leidy. Body long, linear, flattened, anteriorly subacute, posteriorly obtuse or subacute; usually black above, and brownish ash colored beneath, occasionally brownish ash colored with the anterior extremity tipped with black. Head not constricted from the body. Eyes two to four pairs, arranged longitudinally on each side. Length up to six inches, by one-third of a line in breadth. Very abundant, often in masses, about the roots of corallines between tides. Point Judith.

27. *MECKELIA INGENS*, Leidy. Body long, tape-like, narrowed posteriorly, cream colored. Head obtusely angular, depressed; lateral fissures deep. Generative aperture a longitudinal fissure. Described from a specimen preserved in alcohol, and measuring in its present condition, fifteen inches in length, eight lines in breadth and three and a half lines in thickness. It was obtained by Mr. Chas. C. Ashmead, from an oyster bed, at Beesley's Point, New Jersey, and when alive measured more than a yard in length.

## NEMATOIDEA.

PONTONEMA, Leidy. Body capillary, narrowing towards the extremities. Head continuous with the body, obtuse, pointed, with short cirri. Eyes none, caudal extremity obtuse. Generative aperture near the middle of the body. Œsophagus long, cylindrical; intestine cylindrical. Ovaries two. Allied to *Amblyura*. Marine.

28. PONTONEMA VACILLATUM, Leidy. Body cylindroid, with minute cirri anteriorly in addition to those around the head. Tail short, obtuse, incurved. Color brownish white. Length to three-fourths of an inch, by one-fifth of a line in thickness. Found abundantly beneath stones, between tides, at Point Judith.

29. PONTONEMA MARINUM, Leidy. Body cylindroid. Tail long, narrow, blunt. Color white. Length to three lines. Obtained from an oyster bed, in about six feet water, in one of the sounds near Atlantic City, New Jersey.

## ENTOZOA.

30. GREGARINA ———. Body elliptical; head oblate spheroidal. Length .225 mm., breadth .072 mm. From the intestine of *Nereis denticulata*.

31. LEUCOPHRYS CLAVATA, Leidy, (Journ. Acad. Nat. Sc. ii. 50.) In the visceral cavity of *Lumbriculus tenuis*.

32. LEUCOPHRYS COCHLEARIFORMIS, Leidy. (Pl. XI. figs. 62, 63.) Body curved cochleariform. Length .135 to .18 mm. From the intestinal canal of *Lumbriculus tenuis*.

I found four individuals of this remarkable species in a dozen of the *Lumbriculus*. While within the intestine it appeared quiescent, but when set free it moved about actively, by means of its long vibrating cilia, with the bowl-end forward.

## ANNULATA.

NARAGANSETA, Leidy. Body cylindrical, narrowed posteriorly; no lateral pinnae; segments numerous; those anteriorly furnished with a few, simple, cylindrical, lateral tentaculæ; anterior segments with four rows of simple setæ in fascicles; succeeding few segments with two rows of simple setæ, and two rows of cochleariform podal spines; posterior segments with four rows of cochleariform spines. Upper lip distinct, conical, eyes none.

33. NARAGANSETA CORALII, Leidy. (Pl. XI. figs. 46—48.) Body black, brownish or yellowish black, ninety segments in an individual, one inch and a quarter in length. Eight comparatively short tentaculæ on each side of the anterior six segments; three to the first segment; first two the shortest, the third the most robust; orange in color, and except the most robust one, tipped with black. Anterior ten segments with four rows of simple setæ in fasciculi of five; the succeeding four segments with two rows

of simple setæ, and two rows of cochleariform podal spines; and the following segments with four rows of cochleariform podal spines in fasciculi of four to six. Point Judith.

This curious worm lives in tubes within the dead portions of *Astrangea astræformis*. It protrudes the anterior portion of its body with the orange colored antennæ. The latter are contractile, from one to four lines long, and with the exception of the third or most robust one on each side, are tipped with black, as if to be subservient to the impressions of light. Its setæ are quite simple, as represented in figure 47, and are about the fifth of a line in length. The podal spines consist of a long style ending in a bowl, like that of a spoon, as represented in figure 48.

For the new genus, of which the worm just described is the type, I have adopted the Indian name Narragansett, being that of the bay, on the shores of which the animal was first discovered.

34. *SABELLA OCULIFERA*, Leidy. (Pl. XI. figs. 55—61.) Body demicylindroidal, posteriorly narrowed, one hundred and thirty-eight setigerous segments to an individual one and a half inches in length. Tentaculæ twenty-four in number, arranged in the four-fifths of a circle, decreasing in length towards the extremities of the latter, reflected, supplied with about forty-eight secondary tentaculæ, arranged in pairs; two or three black eye spots on the back of the longer tentaculæ. Two rows of setæ in fascicles of about six, and two rows of podal hooks, in transverse series of ten. Setæ in the third to the ninth segment inclusive, in major part spade-shaped with a short subulate point; of the following segments all like the latter. Podal hooks in the first to the tenth segments inclusive, bird-like in form, associated with opposing spade-like podal spines. Podal hooks of the following segments smaller than those anteriorly. Worm living in tough tubes composed of mud, and found in a horizontal position partially concealed beneath masses of *Astrangia astræformis*. Point Judith.

The plumose tentaculæ with the dark eye specks on their back render this worm a beautiful object. The surface of the tentaculæ is everywhere covered with vibrating cilia. By transmitted light the blood appears of a bright green color.

35. *CLYMENE URCEOLATUS*, Leidy. Body cylindrical, composed of segments of various lengths, twenty-six in number including the head and caudal appendage. The anterior eight segments the shortest; the seven preceding the last ten the longest; those in advance of the third, and intervening to this and the sixth and the ninth, without setæ. Head obliquely truncated, concave, with a thin acute margin. Mouth inferior triangular. Caudal appendage large, urceolate, with the margin entire. Color reddish brown. Length five inches; breadth one and a half lines. Raked from the mud in a sound about six feet deep, near Atlantic City, N. J.

36. *CLYMENE TORQUATUS*, Leidy. Body cylindrical, with a membranaceous collar at the fifth segment. Head abruptly truncated, concave, with a thin membranous border emarginate below and on each side. Mouth inferior, at the summit of a double ringed papilla. Length? (the posterior portion of the only specimen found, is either wanting or the body terminates very abruptly.) The anterior fourteen segments measure one inch and a half in length by one line in breadth. Found with the preceding species.

37. *PECTINARIA AURICOMA*, Grube. (*P. Belgica*, Grube, Gould; *P. Grœnlandica*, Grube, Stimpson)? Body composed of nineteen segments including the head and tail. Paleæ eight to sixteen in a fasciculus, according to age. Twenty-eight denticulations to the frontal border. Length up to an inch and a half. Point Judith and Great Egg Harbor.

38. *TEREBELLA ORNATA*, Leidy. (Pl. XI. figs. 44, 45.) Body with about one hundred segments, of which forty-five are setigerous. The anterior ten ventral plates transversely oblong square, those succeeding abruptly diminished in size. Tentaculæ numerous; branchiæ in three pairs. Color brownish red. Length to four inches. Lives in tubes of mud. Found at Point Judith, Atlantic City, and Beesley's Point.

I found the young of this species at Point Judith. It had the appearance of that of *Terebella nebulosa*, Mont., represented in fig. 24, pl. 3, of M. Edward's Rech. Anat. et Phys. etc. The single specimen obtained was three lines long. There were twelve tentaculæ, twenty-five eyes around the head, and twenty-eight segments to the body, of which sixteen were setigerous.

39. *SPIROBIS SPIRILLUM*, Lamarek. On *Chondrus crispus*. Point Judith.

*TORQUEA*, Leidy. Body cylindrical, narrowed at the extremities. Tentaculæ numerous, attached laterally to the head, capable of very great extension and contraction by the passage to and fro of blood corpuscles from the cavity of the body. Eyes none. Setæ in two rows, three to twelve in a fasciculus, extremities lanceolate. Podal hooks in two rows, short, from twelve to forty in each transverse series, supported at the edge of a laminar process stiffened with fine, simple setæ.

40. *TORQUEA EXIMIA*, Leidy. (Pl. XI. figs. 51, 52.) Body soft, blood red. Tentaculæ very numerous, capable of very great extension by the propulsion into them of the bright red corpuscles, with which the cavity of the body is filled. Setæ anteriorly in fasciculi of twelve, posteriorly from three to six. Podal hooks commencing at the eighth segment, from twelve to forty in each series. Worm half an inch to an inch in length, with from forty to sixty segments. Obtained from mud and sand below low tide mark. Point Judith.

This worm is remarkable for its softness, its blood red color, its numerous extensi-

ble tentaculæ, and its numerous podal hooks. It is capable of slowly progressing, by means of its tentaculæ. In the process, these are extended by having forced into them the bright red corpuscles which fill the visceral cavity of the body, they then attach themselves by their extremities to the surface upon which the animal is lying, and by subsequent contraction the body is dragged after them.

41. *CIRRHATULUS FRAGILIS*, Leidy. (Pl. XI. figs. 39—43.) Body cylindrical, narrowed towards the extremities, reddish orange color, posteriorly greenish. Mouth inferior, circular; upper lip conical. Eyes two. Cirri numerous, orange colored; the first pair, commencing at the second setigerous segment and the most robust. Setæ in two rows, simple, in fasciculi of three to five. Podal hooks in two rows, five to eight in each fasciculus, sigmoid, bifid at the free extremity. Intestine cylindrical, constricted. Ovaries on each side of the intestine, extending four-fifths the length of the body. Worm three lines long, by one-fourth of a line broad, and composed of forty annulations. Found under stones, on the shores of Point Judith.

42. *LUMBRICONEREIS SPLENDIDA*, Blainville. Body cylindrical, copper-red and strongly iridescent. Upper lip conical; mouth round, with a short proboscis armed with an inferior pair of dental plates, as well as a complex dental apparatus above and within. Eyes four. Caudal segment furnished with a pair of minute cirri. Lateral tubercles with from six to ten setæ in two fasciculi. Setæ simple, distally curved and grooved and ending in a subulate point. Length up to eighteen inches, with as many as 420 segments. Raked from oyster beds, in Great Egg Harbor, N. J., where it is abundant. The animal corresponds closely with De Blainville's description of a specimen, the country of which, he remarks, he did not know.

43. *EUNICE SANGUINEA*, Montagu. Body compressed, cylindroid, brownish red, iridescent. Head with two oval dorsal lobes. The five antennæ nearly equal. An eye situated between the outer two antennæ. Branchiæ blood red, commencing at the sixteenth segment and continuing until within about forty segments of the posterior extremity. Setigerous tubercles of the anterior sixteen segments containing two spines, the remainder containing four. Setæ in two fasciculi to each tubercle, simple and compound, the latter consisting of a scalpel like blade received into a forked handle. Length to five inches, with two hundred, and twenty segments. Found with the preceding.

44. *GLYCERA AMERICANA*, Leidy. (Pl. XI. figs. 49, 50.) Body cylindrical, brownish red. Upper lip short, with hardly perceptible antennæ. No branchial appendages except three minute dorsal papillæ upon the pinna. The latter five-lobed, armed with two spines and four fasciculi of simple and compound setæ, thirty to forty in number to each pinna. Simple setæ linear, awned; compound setæ composed of a



furcate handle and a long linear lanceolate blade. Length up to five inches, with a breadth of one and a half lines, and about 240 setigerous segments, between each of which is a secondary ring. Found at Point Judith, Atlantic City, and Great Egg Harbor. It is most like the *Glycera capitata* Oersted, but nevertheless is a different species.

45. NEREIS DENTICULATA, Stimpson. Abundant at Point Judith, R. I., and on the shores of Great Egg Harbor, N. J.

46. SIPHONOSTOMUM AFFINE, Leidy. Body cylindro-fusiform, minutely papillated, with four rows of fasciculi of setæ; those of the anterior three segments directed forward; those of the first segment one-third of an inch long; those of the third segment one line long. Length to three inches, by two lines broad, with 80 segments. Obtained by Mr. Ashmead, from Beesley's Point, N. J.

47. LEPIDONOTE ARMADILLO, Leidy. (*Aphrodita armadillo*, Bosc.; *Lepidonote punctata*, Oersted, Stimpson; *Polynoe squamata*, M. Ed., Gould)? (Pl. XI. fig. 54.) Body of twenty-four segments, with twelve pairs of elytræ completely covering the back. Elytræ fringed externally, spotted with variously colored papillæ. Head round, with two pair of eyes, three anterior tentaculæ and three lateral tentaculæ; the middle of the anterior and the first of the lateral tentaculæ the longest, the former with two eye-like black spots, the latter with none; all the others with a single black eye-like dilatation or spot. Dorsal and anal cirri with black eye-like dilated spots. Length an inch and a quarter, by three lines wide. Point Judith and Great Egg Harbor. The *Lepidonote squamata* is described as having five tentaculæ; in *L. armadillo* I in no case could find less than nine, as represented by figure 54.

48. SIGALION MATHILDÆ, Aud. et Edw. (Pl. XI. fig. 53.) Body composed of over 200 segments, with over 150 pairs of elytræ completely covering the back. Head with five antennæ, of which the outer ones are the longest and most robust, the middle one is next in length, and the second is the shortest. Eyes four, those anterior nearly concealed by the bases of the second antennæ. Setæ of the dorsal pinnæ simple; those of the ventral pinnæ compound. Length over five inches, by two and a half lines in breadth. Described from a specimen, with the posterior extremity lost, obtained by Mr. Ashmead, at Beesley's Point, N. J.

49. OPHELIA SIMPLEX, Leidy. Body fusiform, above convex, below flattened, anteriorly and posteriorly acute, reddish brown. Mouth inferior, round. Cirri commencing at the third and ceasing about the twentieth segment. Setæ in two lateral approximated fasciculi, simple, linear. Length two-thirds of an inch, with about 30 setigerous segments. Taken from below low tide at Point Judith.

50. LUMBRICULUS TENUIS, Leidy. (Pl. XI. fig. 64.) Body cylindrical, linear, bright

red, composed of sixty or more segments; ninth to the eleventh segment inclusive, slightly thickened; two generative apertures on each side of the ninth segment. Four rows of podal hooks, anteriorly five or six in each fasciculus, posteriorly three or four in each fasciculus. Length up to an inch and a half, by the fourth of a line in breadth. Abundant about the roots of grasses on the shores of a sound on Point Judith.

## CRUSTACEA.

51. OCYPODE ARENARIA, Say. Great Egg Harbor.
52. GELASIMUS PUGILATOR, Desmarest. Absecom and Great Egg Harbor; in immense numbers, at margins of salt meadows, or upon salt flats.
53. GELASIMUS MINAX, Le Conte. From a brackish spring at Great Egg Harbor, and at Dennis Creek, N. J. Discovered by Mr. Ashmead.
54. SESARMA CINEREA, Say. Absecom and Great Egg Harbor.
55. SESARMA RETICULATA, Say. Absecom and Great Egg Harbor.
56. PINNOTHERES OSTREUM, Say. Point Judith, Absecom, and Great Egg Harbor.
57. PINNOTHERES MACULATUM, Say. Point Judith. Frequent in *Mytilus edulis*. Say gives the muricated Pinna of our coast as the animal which protects this parasitic crustacean. His description also closely applies to the parasite of our *Mytilus edulis*, which is a curious fact as the same species of *Mytilus* of Europe contains the *P. mytilorum*, which is quite distinct from the *P. maculatum*.
58. PLATYCARCINUS IRRORATUS, M. Edw. Point Judith; Great Egg Harbor.
59. PLATYCARCINUS SAYI, Dekay. Point Judith; Great Egg Harbor.
60. PLATYONICHUS OCELLATUS, Latr. Point Judith; Newport; Great Egg Harbor.
61. LUPA DICANTHA, M. Edw. Point Judith; Absecom; Great Egg Harbor.
62. LUPA MACULATA, Say. Great Egg Harbor. Obtained by Mr. Ashmead.
63. CARCINUS MÖENAS, Leach. Point Judith; Newport.
64. PANOPEUS HERBSTII, M. Edw. Newport; Great Egg Harbor.
65. PANOPEUS WURDMANII, Gibbes. Delaware Bay. Obtained by Mr. Ashmead.
66. HYAS COARCTATA, Leach. Great Egg Harbor. Obtained by Mr. Ashmead.
67. HIPPA TALPOIDEA, Say. Point Judith; Absecom; Great Egg Harbor.
68. PAGURUS POLLICARIS, Say. Newport; Point Judith; Great Egg Harbor.
69. PAGURUS LONGICARPUS, Say. Newport; Point Judith; Great Egg Harbor.

70. *CRANGON SEPTemspinosus*, Say. Great Egg Harbor. Obtained by Mr. Ashmead.

71. *GEBIA AFFINIS*, Say. Great Egg Harbor. Mr. Ashmead.

72. *SQUILLA EMPUSA*, Say. Newport. Obtained by Samuel Powell, Esq.

73. *PYCNOGONON* ———? Point Judith.

74. *CAPRELLA* ———? Point Judith.

75. *CALIGUS* ———? Attached to the fin of a shark. Great Egg Harbor. Obtained by Mr. Ashmead. This and the preceding two crustaceans I have not had the leisure to determine.

76. *POLYPHEMUS OCCIDENTALIS*, Lam. Point Judith; Absecom; Great Egg Harbor. In the latter locality in immense numbers.

77. *LIGIA* ———? Point Judith.

78. *LIMNORIA TEREBRANS*, Leach. Absecom.

79. *IDOTEA IRRORATA*, M. Edw. Point Judith; Absecom; Great Egg Harbor. Numerous varieties, and in great abundance in the first mentioned place.

80. *IDOTEA TRILOBA*, Say. Great Egg Harbor. Obtained by Mr. Ashmead.

81. *ORCHESTIA GRYLLUS*, Gould. Point Judith. Abundant.

82. *CEPON DISTORTUS*, Leidy. (Pl. XI. figs. 26—32.) *Female*. Body compressed and distorted ovoid, white; abdominal scales completely concealing the pinkish white ova. Head prominent, provided with a pair of large oval disks situated posteriorly. Mouth minute, at the summit of a trilobate papilla. Antennæ very small and indistinct. Divisions of the thorax posteriorly strongly costate. Feet in seven pairs, curved forward and downward, ending in a short recurved, abortive hooklet. Abdomen deeply segmented. Branchial appendages lanceolate, fringed. *Male*. Body long and slender, divided into fourteen segments. Head subrotund. Internal antennæ short and robust, three jointed; joints spinous. External antennæ long, seven jointed; the first two joints spinous, the others bristled. First joint of the thorax transversely oblong, the remainder depressed, pyriform in outline. Feet in seven pairs, the antepenultimate joint spinous, the penultimate joint broad and with the claw recurved. Abdominal segments depressed, pyriform in outline, each provided with a pair of peculiar ventral appendages, and, except the fifth one, with a lateral irregular pigment cell. Caudal segment round, with a pair of divergent appendages. Length of female four lines, breadth three lines; length of male one and a quarter lines. Found in the branchial cavity of *Gelassimus pugilator*, at Atlantic City.

The genus *Cepon* was first described by Duvernoy, in the fifteenth volume of the *An. des Sciences Naturelles*, but the individual he indicates as being the male of *Cepon typus* is evidently the female of another species. *Cepon distortus* is not a very abundant parasite, for after having accidentally found a specimen, in searching for others, I destroyed fifty fidler crabs without obtaining a second. The parasite produces no deformity, visible externally, of the animal it infests. The male was found in the embrace of the female, as commonly observed in the isopodous crustacea.

In making out the foregoing list of crustacea, I have availed myself of the aid of Dr. Bridges' knowledge of this class of animals.

## CIRRIPEDIA.

83. ANATIFA STRIATA, Brug. 84. ANATIFA LÆVIS, Brug.

85. ANATIFA DENTATA, Brug.

86. BALANUS BALANOIDES, Stimpson. The four species of cirripeds have been observed at Point Judith, Atlantic City, and Beesley's Point.

## RADIATA.

87. ASTERACANTHION RUBENS, Müll. et Trosch. Very abundant at Point Judith.

88. ECHINUS GRANULATUS, Say. Abundant at Point Judith.

## REFERENCES TO PLATES X. AND XI.

Fig. 1.—A branch of *Eucoryne elegans*, the size of nature.

Fig. 2.—*Eucoryne elegans*. A portion of a stem with three branchlets and polypes. a, young bud; b, medusa bud fully developed; c, young medusa bud. Magnified.

Fig. 3.—A polype of *Eucoryne elegans*, with two fully developed medusa buds (b) and a young one (c).

Fig. 4.—*Eucoryne elegans*. Extremity of one of the filiform tentaculæ with the filiferous cells (a) placed inferiorly and at the tip, and with an axis of large nucleated cells (c). Highly magnified.

Fig. 5.—*Eucoryne elegans*. Extremity of one of the superior tentaculæ with the globular end filled with filiferous cells (a), a few of which (b) are represented as separated and with their threads ejected. c, central axis of large nucleated cells, surrounded with muscular fibres and a ciliated epithelium.

Fig. 6.—A filiferous cell of the *Hydra*, resembling those of *Eucoryne*. Highly magnified.

Fig. 7.—A filiferous cell of the *Hydra*, with the style and thread emitted.

Fig. 8.—Two styliferous cells, highly magnified, from the tentaculæ of *Laomedea*.

Figs. 9—16.—Filiferous cells of *Astrangia astræformis*, highly magnified.

Fig. 9.—Filiferous cell with a style; from the tentaculæ.

Fig. 10.—Filiferous cell with a style; from the white cords of the interior of the body.

Figs. 11, 12.—Filiferous cells; from the white cords.

Figs. 13, 14.—The same as figs. 11, 12, with the apparent structure of the partially emitted thread.

Figs. 15, 16.—Filiferous cells, with the thread partially and the style entirely emitted, exhibiting their apparent structure.

Figs. 17—21.—Filiferous cells, from the interior white cords of the body of *Actinia marginata*.

Figs. 17, 18.—Filiferous cells with styles.

Fig. 19.—One of the varieties of filiferous cells with the thread and style emitted.

- Fig. 20.—The same as fig. 19, more highly magnified, exhibiting the apparent arrangement of the emitted structure.
- Fig. 21.—A second variety of the filiferous capsules, with the apparent arrangement of the emitted structure.
- Fig. 22.—Cells of *Escharina lineata*. Magnified.
- Fig. 23.—Cells of *Escharina pediostoma*. Magnified.
- Fig. 24.—A retracted polype of *Alcyonidium? pellucidum*. Magnified.
- Fig. 25.—*Pedicellina americana*. Magnified.
- Fig. 26–32.—*Cepon distortus*. Highly magnified.
- Fig. 26.—Posterior view of the male.
- Fig. 27.—Head of male, with the antennæ.
- Fig. 28.—A right foot of the male.
- Fig. 29.—The abdominal segments of the male, with peculiar appendages (branchial?).
- Fig. 30.—Dorsal view of the female.
- Fig. 31.—Ventral view of the female.
- Fig. 32.—A foot of the female.
- Fig. 33.—*Clava multicornis*. Magnified.
- Fig. 34.—*Clava multicornis*, with bunches of ova. Magnified.
- Fig. 35.—*Hydractinia echinata*. a, neuter individuals; b, ovigerous individuals. Magnified.
- Fig. 36.—Polypidom of *Laomedea dichotoma*.
- Fig. 37.—Cells of *Escharina variabilis*.
- Fig. 38.—*Bowerbankia gracilis*.
- Fig. 39–43.—*Cirrhatulus fragilis*.
- Fig. 39.—The worm, having many of the cirri broken off.
- Fig. 40.—Side view of the head.
- Fig. 41.—Extremity of one of the cirri, more highly magnified.
- Fig. 42.—Fasciculus of setæ.
- Fig. 43.—One of the podal hooks.
- Fig. 44.—One of the setæ of *Terebella ornata*.
- Fig. 45.—One of the podal hooks of *Terebella ornata*.
- Fig. 46.—Anterior extremity of *Naraganseta coralii*.
- Fig. 47.—One of the setæ of *Naraganseta coralii*.
- Fig. 48.—One of the podal hooks of *Naraganseta coralii*.
- Fig. 49.—Pinna from the anterior third of *Glycera americana*.
- Fig. 50.—Pinna from the posterior third of *Glycera americana*.
- Fig. 51.—Two views of one of the setæ of *Torquea eximia*.
- Fig. 52.—Podal hook of *Torquea eximia*.
- Fig. 53.—Head of *Sigalion Mathildæ*.
- Fig. 54.—Head of *Lepidonote armadillo*.
- Fig. 55.—Tentaculæ of *Sabella oculifera*. a, eye-spots.
- Fig. 56.—One of the tentaculæ of *Sabella oculifera*. a, eye-spots.
- Figs. 57, 58.—Two forms of setæ of *Sabella oculifera*.
- Fig. 59.—One of the posterior podal hooks of *Sabella oculifera*.
- Figs. 60, 61.—Associated setæ and podal hook from the anterior part of the body of *Sabella oculifera*.
- Figs. 62, 63.—*Leucophrys cochleariformis*.
- Fig. 64.—A podal hook of *Lumbriculus tenuis*.

ART. XII.—*Descriptions of new species of PSITTACIDÆ, in the collection of the Academy of Natural Sciences of Philadelphia.*

BY JOHN CASSIN.

1. *ARA AURICOLLIS*, Cassin, Proc. Acad. Nat. Sci., Philada. vi. p. 372. (June, 1853.)

*ARA AURITORQUES*, Massena et Souance, Rev. et Mag. de Zool., 1854, p. 71, (Feb.)

*SITTACE PRIMOLI*, Bonaparte, Rev. et Mag. de Zool., 1854, p. 147.

PLATE XII. Adult.

*Form.*—Rather smaller than *Ara severa*, (Linn.) Bill abruptly curved, culmen flattened, bare space commencing at the nostril, including the eye and completely inclosing the under mandible. Wing rather long, second and third quills longest and nearly equal; tail graduated, containing twelve feathers.

*Dimensions.*—Total length (of skin) from tip of bill to end of tail about 15 inches, wing  $8\frac{1}{2}$ , tail  $8\frac{1}{2}$  inches.

*Colors.*—A large spot of yellow on the back of the neck, somewhat rectangular in shape, and extending slightly on to the sides of the neck at its lower edge.

Head above, from the base of the bill to the crown, black, which is also the color of the cheeks immediately next to the bare space. Occiput and all other parts of the plumage, except the wings and tail, green, tinged with yellowish on the back and wing coverts, and very slightly with bluish on the occiput. Primaries and secondaries light blue; tertiaries same yellowish green as other plumage. Tail with the two central feathers on their upper surface reddish chestnut or maroon for the greater part of their length, yellowish green at base, and towards the end subterminally light blue and narrowly tipped with yellow! Other feathers of the tail much the same, but with the light blue predominating on their outer webs, and yellowish green on their inner webs. Under surfaces of wings and tail pale silky yellow.

*Hab.*—South America; Bolivia.

*Obs.*—Peculiarly characterized by the large yellow patch on the neck behind, and bearing no very near relationship to any species known to me. Three specimens, very similar in plumage, are in the collection of the Academy, two of which have been labelled in Europe as natives of Bolivia, the other is without label.

2. *CHRYBOTIS VIRIDIGENALIS*, Cassin, Proc. Acad. Nat. Sci., Philada., vi. p. 371. (June, 1853.)

PLATE XIII. Adult Male.

*Form.*—About the size of *C. autumnalis*, (Linn.) Bill strong, culmen curved from the base and slightly grooved. Wing with the second, third and fourth quills longest

and nearly equal; quills broad, tail of twelve feathers, moderate, rather broad; tarsi short, robust; small space around the eye, bare.

*Dimensions*.—Total length (of skin) from tip of bill to end of tail about 12 inches wing 8, tail  $4\frac{1}{2}$  inches.

*Color*.—Top of the head from the base of the bill, fine crimson, varying in extent in different specimens; other plumage of the head above, green at the base of the feathers, many of them having subterminal transverse bands of bluish cinerous, and all narrowly tipped with black. Cheeks fine pale green, (with no yellow nor red.)

Entire plumage above and below, green; dark on the back and tinged with yellow on the under parts; every feather of the back, rump, neck, breast and abdomen narrowly tipped or edged with black. First primary black, others green for the greater part of their length, but bluish black at their tips. A large spot of fine crimson occupying about the middle third of the first five or six secondaries, which are tipped with fine blue. Tail above and below dark green at its base, terminal portion greenish yellow, central feathers darkest, some of the outer feathers edged with reddish chestnut at their bases. Under tail coverts yellowish green, shafts of the feathers black. Bill (in skin) pale yellowish.

*Hab*.—South America. Brazil?

*Obs*.—Several specimens of this bird are in the collection of the Academy, variously labelled, but mostly "*Psittacus vernans?*" and "*Amazona lilacina*. Less." It is not the latter, and I do not know the former, if there is such a species.

This species considerably resembles *C. autumnalis*, (Linn.) but is invariably smaller and has no yellow markings on the face. The bill is clear yellowish white, with no tinge of brown or horn color, as in that species. The extent of the space on the head occupied by both the crimson and bluish ash colors, varies much in different specimens, and in one the latter color is nearly invisible.

3. PSITTACULA LINEOLA, Cassin, Proc. Acad. Nat. Sci., Philada. vi. p. 372, (June, 1853.)

Plate XIV. Fig. 1.

*Form*.—Small, size of *P. passerina*, (Linn.) Wing with the first and second quill longest and nearly equal; tail feathers pointed, the two central feathers longest, acuminate; bill tumid; tarsi and feet strong.

*Dimensions*.—Total length (of skin) about 6 inches, wing 4, tail  $2\frac{1}{2}$  inches.

*Colors*.—Shoulders black. Entire plumage above and below green, slightly tinged with brownish on the back, and with yellow on the under parts, rump, upper and under tail coverts, most obvious on the latter. Every feather of the entire plumage, except the quills and tail narrowly tipped with black, nearly obsolete on the middle of the breast and abdomen, but very conspicuous on the head, neck, back rump



coverts of the wings and tail, sides and flanks, and assuming the form of circular terminal spots on the upper and under coverts of the tail.

Quills green on their outer webs, brownish black on their inner webs, tinged with green and paler on their inner margins. Tail feathers green, the two central feathers with a line of brownish black along their shafts and tipped with the same color, other tail feathers also brownish black along the shafts and on their inner margins. Bill, tarsi and toes light colored.

*Hab.*—Mexico, National Bridge.

*Obs.*—This handsome little parrot does not appear to be nearly related to any other, but in general appearance bears a greater resemblance to some of the small Australian species, than to any that are American. Two specimens are in the collection: one brought by Mr. Pease from the vicinity of the National Bridge, and the other is in a collection made by M. Bruzin, also from Mexico.

4. *BROTOGERIS AURIFRONS*, *nobis*. Nov., 1855.

Plate XIV. fig. 2.

*Form.*—Similar to that of *B. chrysoptera*, (Linn.,) but larger. Bill rather compressed, upper mandible lengthened; wing long, first and second quills longest and very nearly equal; tail short, somewhat rounded; feathers narrow at the tips; tarsi and toes robust.

*Dimensions.*—Total length (of skin) about  $6\frac{1}{2}$  inches; wing  $4\frac{3}{4}$ ; tail  $2\frac{3}{4}$  inches.

*Colors.*—Narrow band in front (at the base of the upper mandible) and small spot on the throat dark reddish orange. Inner of the greater coverts of the wings reddish orange, fading into paler yellow at the ends, and forming a conspicuous spot on the wing.

General color green, slightly tinged with brown on the back and with yellow on the under parts of the body. Quills bluish-black, edged outwardly with green. Tail green, with all the feathers yellowish on their inner edges, and on its under surface silky greenish yellow. Under surface of the wings pale blue. Bill and feet pale dull yellow.

*Hab.*—South America,

*Obs.*—This bird is related to *B. chrysoptera*, but is larger, and may be immediately distinguished by its frontal band and spot on the throat of dark reddish orange. Several specimens are in the collection of the Academy.

5. *PRIONITURUS FLAVICANS*. Cassin, Proc. Acad. Nat. Sci. Philada., VI., p. 373, (June, 1853.)

*Form.*—Similar to that of *P. platurus* (Vieill.) and *P. discurus* (Vieill.,) but larger than either. Bill strong, rather tumid; wings long, second and third quills longest

and nearly equal; tail moderate, rather wide, the two central feathers with their shafts exerted and with spatula-formed tips; tarsi and toes robust. A small bare space at the base of the upper mandible.

*Dimensions*.—Total length (of skin) about 11 inches; wing  $7\frac{1}{2}$ ; tail 5 inches.

*Colors*.—Entire under parts greenish yellow, extending upwards and forming a wide collar around the neck, the yellow most clear and distinct on the breast and collar, greener on the abdomen and inferior coverts of the tail.

Head green, tinged with light blue on the vertex. Body, wings and tail above, dark green; first primary light blue on its outer edge; all the quills margined with brownish-black on their inner webs; tail tipped with black and with its inferior surface greenish blue. Bill, in dried specimen, nearly white, tinged with horn color at its base.

*Hab*.—Celebes.

*Obs*.—The only specimen of this bird in the collection, is one of the many valuable contributions to our collections made by Mr. Edward Wilson, and is labelled as a native of the island of Celebes. It is quite different from either *P. platurus* or *P. discurus*, both of which are in the collection of the Academy, and is peculiarly characterized by its yellow breast and wide cervical collar of the same color.

6. PALÆORNIS GIRONIERI. Verreaux, Rev. et Mag. de Zool. 1853, p. 195 (May.)

PALÆORNIS VIRIDICOLLIS. Cassin, Proc. Acad. Nat. Sci. Philada., VI., p. 373 (June, 1853.)

The paper in the Proceedings of the Academy in which the species above given are originally described, contains also a description of the present bird, of which several specimens have been sent from Europe by Mr. Edward Wilson. It was however described a short time previously by Messrs. Verreaux, as above, whose name is of course to be adopted.

# CORRIGENDA.

Page 82, line 4, for "oblonge-linearibus," read oblonge linearibus.

" 82, " 17, for "sacciforme," read sacciformi.

" 83, " 7, for "3-distinctis," read 3 distinctis.

" 83, " 19, for "Douglassii" (and the same word in the sequel) read *Douglasii*.

" 83, " 23, for "ample elliptice-cylindrico," read amplo, elliptice cylindrico.

" 85, " 14, for "Fruticulus," read Fruticosus.

" 85, " 16, for "subumbellatiformibus," read subumbelliformibus.

" 86, " 16, for "foliis," read foliolis.

" 92, " 22, for "but the cup-shaped," read but has cup-shaped, and erase the comma after corolla in the following line.

" 95, " 33, after D. C., add Hook. Bot. Mag. T. 3622.

" 96, " 9, for "cauli," read caule.

" 101, " 15, for "sepalis," read sepala.

" 103, " 3 and 10, for "Schoenolerion," read Schoenolerion.

" 103, " 6, for "stigmatē," read stigma.



ART. XIII.—*Descriptions of some remains of fishes from the Carboniferous and Devonian Formations of the United States.*

By JOSEPH LEIDY, M. D.

EDESTUS, Leidy.

*Generic Characters.*—Maxillary bones segmented ; segments beveled anteriorly and excavated posteriorly for coadaptation. Teeth in general form resembling those of *Charcharodon* ; one coossified with each maxillary segment.

EDESTUS VORAX, Leidy.

Proc. Acad. Nat. Sci., vii, 414. The subject of the present description is a fossil fragment of the jaw of a remarkable and gigantic fish, which was presented to the Academy by William S. Vaux, Esq., who obtained it from an itinerant showman. The latter informed Mr. Vaux, that the specimen was discovered at Frozen Rock, Arkansas river, twenty miles below Fort Gibson, in the Indian Territory.

The specimen is dense, heavy, and jet-black ; and when it was first received the crevices about its surfaces were filled with carbonaceous matter. It was probably derived from a coal bed ; but the geological features of the locality from which it was obtained I have been unable to learn.

The fragment of jaw is six inches in length ; and it measures three inches in depth from the dental border. The sides are symmetrical, and slope divergently from the latter position towards the base, which is convex and moderately keeled in the median line. At the dental border the jaw is about seven eighths of an inch in thickness, and and at the thickest part of its base measures one inch and four-fifths. Longitudinally the base of the jaw is slightly concave and furrowed. The surface of the bone is covered with fine vermicular, reticulating, broken ridges, assuming a striking resemblance to arabic writing.

The most remarkable peculiarity of the jaw is its segmented character ; and of the segments the fossil retains two very nearly perfect ones with portions of two others. Each segment in outline forms an irregular pentahedron ; and each possesses a single coossified tooth, whose broad surfaces abruptly increase the acclivity of the sides of the jaw.

From its general form the fossil might readily be taken for a portion of the lower jaw, but from the fact that no vertebrated animal, neither living nor extinct, has yet been discovered in which the dental branches of the inferior maxilla are segmented, while several genera are known, as the *Lepidosteus* among living fishes, and the

*Dendrodus* of the Old Red Sandstone,\* in which the superior maxillæ are segmented, therefore it is a fair inference that the fossil in question is a portion of an upper jaw.

The maxillary segments of the fossil are beveled off on each side anteriorly to a nearly acute edge, and are excavated posteriorly, so that the succeeding segments shall fit into those in advance. Each segment contributes to the sides of the jaw a band-like surface curving from the dental border as far back as the position of the second succeeding tooth, and then turning forward at a nearly right angle to the base of the jaw, so that when the segments are conjoined they appear separated on each side by  $\triangleright$  like grooves.

Near the middle of the anterior margin of the beveled portion of the segments, on both sides there exists an oval foramen, the apparent continuation of a dental canal.

The teeth of the fossil are so closely set upon the jaw that the anterior basal angle of those behind passes the contiguous angle of those in advance. Of the portions of four teeth retained in the fossil, two are sufficiently well preserved to obtain some idea of their form when perfect, as represented in the outlines of figure 1, plate 15. In general form they appear to be like those of *Charcharodon*, but differ in a number of important characters. They are compressed, conical, with coarsely dentated, trenchant edges. Their two broad sides are symmetrical; and they curve forward, so that in the restored condition their anterior margin appears to be convex and the posterior margin concave. Their base presents on each side a lobe-like expansion which extends upon the sides of the jaw, so that they look as if they were excavated and fitted upon the dental border of the maxillary segments.

The width of the teeth at base is one inch and nine tenths, the thickness in the same position four fifths of an inch, and the probable length is about two inches. The denticles are slightly compressed conical, with trenchant edges, and are nearly two lines long and over one line broad. In structure the teeth are solid and consist of hard dentine, which is however of looser texture toward the centre; and they are invested with smooth, shining enamel, about the one sixth of a line in thickness.

The teeth are firmly coossified with the maxillary segments, and indeed their dentinal structure is absolutely continuous with, and undistinguishable by the naked eye from the nearly equally dense ossific structure of the jaw.

A careless inspection of the fossil, at its posterior broken border would mislead one to suppose the teeth were inserted by long fangs into the jaw, an appearance which arises from the narrow portion of one fragment, continuous with its tooth, being received into the excavation of the segment in advance.

Plate 15, figs. 1, 2.—Views of the two broad surfaces of a fragment of the jaw of *Edestus vorax*.

fig. 3.—Outline view of a vertical section of the jaw.

fig. 4.—Outline of transverse section of the teeth, from the same specimen.

\* Agassiz, *Pois. Foss.* t. ii, pt. 2, p. 13.

## ORACANTHUS, Agassiz.

*Generic Characters.* Dorsal rays very large, compressed conical, with a large interior cavity; the external surface furnished with oblique and longitudinal rows of tubercles or tuberculated ridges; without posterior rows of denticles.

ORACANTHUS VETUSTUS, Leidy.

Proc. Acad. Nat. Sci., vii. 414. This species is proposed upon an ichthyodorulite or dorsal ray, from the collection of Mr. Timothy Conrad, now forming part of the cabinet of the Academy. The specimen is from Missouri Territory, but the exact locality from which it was obtained is unknown. It is dense, jet black, and heavy; and it has its apex and base broken away. On one side towards the base it is crushed inwardly, and in this position there is a portion of adherent iron gray limestone, with a partially imbedded segment of a crinoidal stem, which Mr. Conrad views as an evidence that the dorsal ray was derived from the carboniferous limestone. In several places the ray is fissured; but the parts appear to have retained their original relationship, and the form of the ray is nearly perfect.

In its present condition the specimen is five inches long and two and two-thirds of an inch wide at the base; and its thickest portion is about eight lines. Its form is flattened pyramidal and is curved a little backward and slightly also to one side. The broad sides and posterior margin are thickly covered with mammillary tubercles but the anterior margin is smooth. Between the tubercles the surface is slightly striated. On the right side the tubercles are arranged in rows, irregularly longitudinal, and irregularly oblique in the transverse direction. On the left side they are arranged more regularly in longitudinal rows, and they evince a tendency to become confluent in short transverse rows, which pursue an irregular waving course across the ray. On the posterior margin, which is obtuse, there are several longitudinal rows. The anterior margin of the ray is more obtuse than the posterior; and it narrows towards the base. The thickness of the walls of this ichthyodorulite is not easy to ascertain. The apex of the specimen exhibits a solid bony structure, but the base appears to present thin lateral walls and a thick wall to the anterior border.

Plate 16, figs. 1, 2, 3.—Different views of the ichthyodorulite of *Oracanthus vetustus*.

## PETALODUS, Owen.

*Generic Characters.* Teeth with fangs. Crown demi-compressed-pyramidal, broader than long, with trenchant margins, surrounded by a basal cingulum composed of narrow imbricating folds, and descending lower on one side than the other. Fang large, undivided, laminar.

PETALODUS ALLEGHANIENSIS, Leidy.

*Sicarius extinctus*, Leidy, Proc. Acad. Nat. Sci., vii, 414.

This species of *Petalodus* is established upon the specimen of a tooth, which Mr.



Timothy Conrad borrowed from the cabinet of Charles A. Poulson, Esq., for my inspection. It was presented to the latter gentleman by Townsend Ward, Esq., who, in a note, observes, it was given to him "by the engineer of the stationary engine at the head of inclined plane number 3 of the old portage railroad," which crossed the Alleghany Mountains from Hollidaysburg, in Blair County, Pennsylvania. Mr. Ward further states, "it was obtained from a stratum about one foot thick, black, carboniferous, and calcareous, which was exposed by the excavation for the buildings to accommodate the stationary engine." He then adds, "I obtained quite a number of other fossils there, and from the same stratum near Freeport, above Pittsburg, and I think on the Conemaugh, seventeen miles west of Johnston. I found the stratum distinctly marked at these different localities, and have understood it is also to be seen in Ohio, where it is as distinctly marked by its appearance and fossils. It is in the bituminous coal series, and has a coal seam beneath it."

The tooth is of an iron gray color, hard, well preserved, and perfect, except that the basal angles of the crown and the end of the fang are broken away.

The crown has the form of one half of a broad, compressed cone. Its outer side is smooth, and transversely convex, but slopes in a nearly even plane from the trenchant margins. The inner side is also smooth, and forms a vertical plane from the latter position, and is transversely concave. The trenchant edges, except at the basal angles, are nearly straight, and are minutely serrulated, or rather simply striated.

The basal cingulum surrounding the crown is bow-shaped on each of the broad sides; and it is composed of about nine imbricating, parallel folds. Externally it slopes inwardly beneath the crown; and internally it forms a thick convex ridge descending much below its position externally.

The fang is an osseous plate, thick at the middle and towards the broken end, but thinning towards the lateral borders, which are slightly bent, scroll-like, from within outwardly. The inner surface is transversely concave; the outer one is convex, and presents a wide groove following the course of the basal cingulum.

The measurements of the specimen are as follows: Breadth of the crown (not entire) 14 lines; height, including the basal cingulum, internally  $11\frac{1}{2}$  lines, externally 9 lines. Breadth of the fang  $10\frac{1}{2}$  lines; length (not entire) internally  $4\frac{1}{2}$  lines, externally 7 lines.

Plate 16, figs. 4, 5, 6.—Outer, inner, and lateral views of a tooth of *Petalodus alleghaniensis*.

#### HOLOPTYCHIUS, Agassiz.

*Generic Characters*.—Body broad, short, compressed. Tail heterocercal, short. Head flat; the bones rough, or irregularly granulated. A few large conical teeth folded at the base, and numerous small conical, intermediate ones. Scales large, more or less rounded, rhomboidal; the covered portion smooth; the exposed surface

furnished with coarse, longitudinal, flexuose, anastomosing ridges or tubercles. Ventral fins on each side, posterior to the middle; dorsal fin opposite the anal fin, which is close to the caudal fin; pectorals small.

*HOLOPTYCHIUS AMERICANUS*, Leidy.

*Holoptychius nobilissimus*, Ag., Hall, Geol. of New York, pt. IV, 281, fig. 130.

By this name I propose to distinguish the remains of the genus which have been discovered to the present time in Pennsylvania, although it may possibly include two species. Remains of *Holoptychius* are stated to be quite abundant in certain localities of the Old Red Sandstone Formation of Tioga county; but such as they are, consisting of isolated scales, cranial bones, and teeth, they are so exceedingly friable and the matrix so hard, or so soft and brittle that it is difficult to obtain specimens sufficiently perfect to be characterized. Among numerous specimens, for the most part consisting only of impressions left by the disintegration of the remains, presented to the Academy, by Timothy Conrad, Esq. and Charles E. Smith, Esq., there are a few which I have ventured to describe, and which are represented in figures 9, 10 of plate 16, and figures 1-4 of plate 17.

One of the specimens, represented in figure 9, plate 16, is a portion of a large scale, with an impression of a portion of the remainder. It measures nearly  $2\frac{1}{2}$  inches in length, and apparently has been ovally rhomboidal in its perfect condition. The covered portion of the scale constitutes nearly one half, and is smooth. The exposed surface of the scales, as indicated by the impress of the matrix, was furnished with coarse, longitudinal, flexuose, and somewhat ramifying ridges.

A smaller scale, represented in figure 10, plate 16, of which specimens are more frequent than of the preceding, is 14 lines long and 12 lines broad, and is a rounded square. A little more than half its surface has been covered by the scale in advance; and the exposed portion of the surface is covered with coarse longitudinal ridges. This scale resembles an isolated specimen of one from *Holoptychius nobilissimus*, represented in figure 26, plate 31 a, of Agassiz' Poissons Fossiles, but is not at all like those represented in plate 23 of the same work.

The impression of a tooth, left in a portion of matrix by the destruction of the original, from which a clay cast was taken, gives the form characteristic of the large teeth of *Holoptychius*, as represented in figure 1, plate 17. The tooth has been ten lines long and four lines in diameter at the base. It is conical, circular in transverse section, as represented in figure 2, plate 17, and is folded two thirds of its length from the base.

A very imperfect fragment of a maxillary bone, consisting indeed of little more than the thin internal surface adhering to a portion of matrix, represented in figure 3, plate 17, exhibits at the anterior extremity the remains of a large tooth, partially consisting only of its impression; and further back at the margin of the bone it presents two conical denticles about one line long.

A bone, the most perfect specimen preserved of the remains of *Holoptychius americanus*, represented in figure 4, plate 17, appears to be one of the branchiostegal plates. It is trilateral, is sixteen lines wide, and appears to have been about twenty-two lines long. Its surface exhibits numerous short flexuose ridges, and tubercles, characteristic of the cranial bones of the genus.

Plate 16, figs. 9, 10.—Scales of *Holoptychius americanus*.

Plate 17, fig. 1.—Tooth of *H. americanus*.

fig. 2.—Transverse section of the same tooth.

fig. 3.—Fragment of the lower jaw

fig. 4.—A branchiostegal plate.

### STENACANTHUS, Leidy.

*Generic Characters.* Dorsal spine long, narrow, straight, compressed conical, hollow, longitudinally striated, furnished posteriorly with marginal rows of oblique denticles.

STENACANTHUS NITIDUS, Leidy.

Proc. Acad. Nat. Sci., viii, 11. This genus and species are indicated by the specimen of an ichthyodorulite, imbedded in a fragment of rock of the Old Red Sandstone Formation of Tioga County, Pennsylvania, and discovered by Charles E. Smith, Esq., who presented it to the Academy of Natural Sciences. In the same fragment of rock with the spine, there are also small portions of bones, and the impression of a tooth, apparently of *Holoptychius*.

The specimen has its apex broken off, and also a portion of its left wall, exposing a large interior cavity, filled with the sandstone matrix. It appears to have been perfectly straight in its length, and is long, narrow, compressed conical. The anterior border is convex; the sides are longitudinally striated or grooved; and the posterior border is denticulated. There appears to be a pair of close rows of denticles, though the specimen only exhibits one. The denticles are triangular, directed obliquely downward and backward, and seven of them are equal to the space of half an inch.

About half an inch below the broken summit of the specimen, a zigzag fissure or perhaps a suture crosses the spine, as represented in figure 7 of plate 16. From the two lower angles of the fissure, two others proceed longitudinally downward to the broken margin of the specimen. These appear like real sutures, though they are most probably mere cracks, the result of fracture.

The length of the ichthyodorulite in its present condition is two inches and two thirds, and its width at base about half an inch.

Plate 16, figs. 7, 8.—Ichthyodorulite of *Stenacanthus nitidus*; the former figure representing merely the outline.

### APEDODUS, Leidy.

*Generic Characters.* Opercular bones, thick, covered with hard and finely granulated enamel. Teeth large, compressed conical, with trenchant margins and a grooved base.

*APEDODUS PRISCUS*, Leidy.

This species is founded upon specimens of a tooth and a fragment of bone, from the Old Red Sandstone Formation of Columbia County, Pennsylvania, which were sent for my inspection by Prof. Baird, from the cabinet of the Smithsonian Institution.

The tooth is seven lines in length, compressed conical, with trenchant edges, and is slightly curved. The two broad sides are very nearly symmetrical; the transverse section being elliptical and rather abruptly narrowed towards the acute poles. The trenchant margins are entire, and the surfaces are smooth, except at their lower half, where the tooth is grooved as in *Lepidosteus* and *Holoptychius*. The base of the tooth is four lines and a quarter in breadth, and two lines and a half in thickness. The tooth appears to be solid, and is invested with thin enamel.

The fragment of bone mentioned, which I have considered as having belonged to the same fish as the tooth, for no other reason than that they were found in association, appears to be a portion of an opercular, or perhaps a sub-opercular bone. It is thick and dense, and on the exposed surface is invested with thin, shining, and minutely granulated enamel. Viewing the specimen as an opercular bone, it has been over two inches in length, and about an inch and a half at its widest part. Its anterior margin is thin, and beveled off for the fourth of an inch for adaptation to the preopercular bone. The posterior margin is convex; the lower extremity is a little prolonged; and the upper broken margin of the specimen reaches one line in thickness.

Plate 17, fig. 5.—Tooth of *Apedodus priscus*.

fig. 6.—Transverse section of the same tooth.

fig. 7.—Portion of an opercular bone.

ART. XIV.—*Description of some remains of extinct Mammalia.*

By JOSEPH LEIDY, M. D.

CAMELOPS KANSANUS, Leidy. Proc. Acad. Nat. Sci., vii, 172.

This genus and species are established upon a fragment of the anterior extremity of an upper jaw of an animal of the camel family, discovered by Mr. Henry Pratten, of New Harmony, Indiana, in the gravel drift of Kansas Territory.

The specimen consists of portions of the left maxillary and intermaxillary bones, the latter of which contains the fang of a transformed incisor or functional canine tooth, as in the lama.

The intermaxillary bone is of very much more robust proportions than in the lama or camel. Its upper part and outer surface form the segment of a slightly flattened cylinder, and from the nasal side to the outer side of the aperture of its alveolus it is an inch in breadth, while in the lama in the same position it measures only the third of an inch, and in the camel about half an inch. The inclination of its nasal border approaches more the horizon than in the lama or camel, apparently indicating the animal to have possessed a lower and perhaps a longer face than in either of the latter genera. The gingival border is rugged as in its congeners, and it presents two irregular pits, apparently the alveoli of incisive germs.

The fang of the functional canine contained in the intermaxillary bone is laterally compressed conical, and is an inch and a half in length. From the orifice of its alveolus it is strongly curved upward and backward, nearly on a line parallel with the curved palatal margin of the bone. The crown of the tooth was directed downward and outward; and at the base it is ovate in section, with the narrow end posteriorly; and it measures six lines and three fourths wide, and three lines and three fourths transversely. A small portion of remaining enamel indicates this to have been thin and smooth.

The small remaining fragment of the maxillary bone attached in the fossil exhibits at its broken margin the portion of an alveolus, situated an inch and three fourths behind the tooth contained in the intermaxillary bone. It has been about four lines in transverse diameter, apparently had a direction curving downward, forward, and outward from its bottom, and probably accommodated a true canine tooth, although the position is unusually far back, a necessary condition however in the *Camelops*, from the distance to which the fang of the functional canine tooth extended backward.

The margin of the hiatus between the alveoli indicated is subacute and concave; and it measures one and three fourths of an inch in length. It is divided about the

middle of its course by the maxillo-intermaxillary suture, which descends at the side of the jaw parallel with the nasal border, and on the palate curves inward and advances as far as the position of the posterior third of the orifice of the intermaxillary alveolus.

Plate 17, fig. 8.—Inferior view of a fragment of the upper jaw of *Camelops Kansanus*.

fig. 9.—Outer view of the same specimen.

fig. 10.—Transverse section of the tooth contained in the same specimen.

*CANIS PRIMÆVUS*, Leidy. Proc. Acad. Nat. Sci., vii, 200.

This name is proposed for an extinct species of wolf supposed to be indicated by a fragment of a skull, discovered by Mr. Francis A. Lincke, in association with remains of *Megalonyx Jeffersonii*, *Bison americanus*, *Cervus virginianus*, *Equus americanus*, and *Tapirus Haysii*, in the banks of the Ohio River, near the mouth of Pigeon Creek, a short distance below Evansville, Indiana. The specimen, which with others were kindly borrowed for my inspection by Dr. J. G. Norwood, of New Harmony, consists of the left upper maxillary bone containing the back five molar teeth, which are nearly entire except the penultimate tooth.

The fragment on comparison with the corresponding portion of the skull of the common wolf of Europe, and its american congeners, differs only in being larger and in presenting slight variations in the teeth, not however greater than those found among different varieties, or perhaps even individuals of recent wolves.

Certain naturalists may regard the fossil as indicative of a variety only of the *Canis lupus*, and of the correctness of such a view, an attempt will not be made here to decide. Naturalists have not yet systematized that knowledge through which they practically estimate the value of characters determining a species. What may be viewed as distinct subgenera by one will be considered as only distinct species by another, and a third may view both as varieties or races. In the use of these words, or rather in the attempt to define them, we go too far when we associate them with the nature of the origin of the beings in question. We know nothing whatever in relation to the origin of living beings, and even we cannot positively deny that life connected with some form was not co-eternal with time, space, and matter, and that all living beings have not successively and divergingly ascended from the lowest types.

To return to a consideration of the fossil: the maxilla has the same form as the corresponding bone of recent wolves with which I have had the opportunity of comparing it. The infra orbital foramen, is vertically oval, directed forward, and is on a line vertical to the interval of the third and fourth molar teeth.

The crown of the penultimate molar tooth is rather less concave posteriorly than in any recent specimens under inspection; and its antero-posterior diameter internally is greater in relation with the same diameter externally; or in other words the tooth

internally is less narrowed than in recent wolves. It is also broader in the antero-posterior diameter when compared with its transverse diameter; and its basal ridge externally is a little more abrupt and is slightly crenated at the border.

The second and third molar teeth have their basal ridge internally a little better developed, which is also the case with the internal oblique ridge, descending towards the cusp anteriorly.

The principal measurements of the fossil, in comparison with those of the corresponding part in recent wolves, are given in the following table.

MEASUREMENTS.			St. Bernard Dog, of Europe.	Canis lupus, of Europe.	Canis occidentalis, of Ohio.	White Wolf, from Nebraska.	Canis gigas, Townsends, from Oregon.	Canis primævus. (fossil.)
			lines.					
From base of crown of third molar to upper margin of maxilla, .			25	24	21½	24	26	31
From base of crown of fourth molar to upper margin of maxilla, .			34	36	30	34	36	41
From back of last molar to canine alveolus, . . . . .			38	43	41½	42½	46	53
Antero-posterior diameter of first molar alveolus, . . . . .			3	3½	3½	4	4	4½
Do. do. of second molar tooth, . . . . .			5	6½	7	6½	7	7
Do. do. of third molar, . . . . .			6	8	7¾	8	8	8½
Do. do. of fourth molar, . . . . .			9¾	13	12½	12½	13	16
Do. do. of fifth molar, . . . . .			7	8	8½	8	8	9
Transverse do. do. . . . .			8	10¾	11	10½	10¾	11½
Antero-posterior diameter of last molar, . . . . .			4	4	4¾	4	4¾	4¾
Transverse do. do. . . . .			5½	7	7½	6½	7	7

Plate 17, fig. 11.—Outer view of the fragment of the upper jaw of *Canis primævus*.

fig. 12.—Lower view of the same specimen.

URSUS AMPLIDENS, Leidy. Proc. Acad. Nat. Sci., vi, 303.

This species is founded upon a fragment of lower jaw and an upper molar tooth, which were discovered in association with remains of *Megalonyx*, *Myiodon*, *Ereptodon*, *Equus americanus*, *Cervus virginianus fossilis*, and *Mastodon*, in a ravine in the neighborhood of Natchez, Mississippi.

The fragment of the jaw is of the left side; and it contains the last molar tooth. It has about the same size as the corresponding portion of the jaw of the common black bear (*Ursus americanus*), or of that of the grizzly bear (*Ursus ferox*) at an age when the permanent teeth have all protruded but are not yet worn by attrition. Its form also does not vary from what it is in the latter animals, except that it is more convex externally.

The last molar tooth is intermediate in size to that of the black and the grizzly bear, but the form of the crown is more like that of the former than that of the latter.

The specimen of an upper molar is the penultimate one of the left side. It has very nearly the same form as in the grizzly bear, except that the small cone in front of the outer pair of principal cones is almost as well developed as that behind them.



The slight variations indicated in the fossils might be considered as insufficient to characterise them as having belonged to a distinct species from the grizzly bear, but when we reflect upon the equally slight variations which exist in the homologous parts to the fossils in certain recent species of the genus, and recollect that the fossils in question were found in association with remains of the *Megalonyx*, &c., in a country never known to have been inhabited by the grizzly bear, we cannot help inclining to the belief that they belonged to a species distinct from the recent ones.

The comparative dimensions of the fossils are as follows :

	U. americanus.	U. ferox.	U. amplidens.
Depth of lower jaw below the last molar, . . . . .	15 to 18 lines.	18 to 25 lines.	17 lines.
Antero-posterior diameter of the last lower molar, . . . . .	8 " "	11 " "	9½ " "
Transverse do. do. do. . . . .	5½ " "	7½ " "	7 " "
Antero-posterior diameter of the upper penultimate molar, . . . . .	8½ " "	11 " "	10 " "
Transverse do. do. do. do. . . . .	6½ " "	8 " "	7½ " "

Plate 17, fig. 13.—Outer view of the fragment of the lower jaw of *Ursus amplidens*.

fig. 14.—Triturating surface of the last molar contained in the same specimen.

fig. 15.—Outer view of a left upper penultimate molar.

fig. 16.—Triturating surface of the same specimen.

#### URSUS AMERICANUS FOSSILIS.

Remains of the common black bear (*Ursus americanus*) have on several occasions been discovered in association with those of extinct animals. Dr. Harlan\* mentions an inferior maxilla, which was found in Big-bone Cave, Tennessee, in association with remains of the *Megalonyx*. The specimen, which is preserved in the collection of the Academy, contains none of the teeth, and it is unchanged from the original texture, except that it has lost a small portion of its gelatin. It is not improbable that the specimen may be of much later date than the *Megalonyx* remains with which it was found.

Another specimen preserved in the cabinet of the Academy, consists of the left half of the lower jaw containing the canine and anterior two molar teeth of a species of bear, discovered in a ravine in the vicinity of Natchez, Mississippi, in association with remains of *Megalonyx*, *Myiodon*, *Ursus amplidens*, *Equus americanus*, *Bison latifrons*, *Cervus*, &c. The specimen corresponds closely in its anatomical characters with its homologue of the common black bear. The bone is exceedingly friable, and is enveloped in a thick layer of compact peroxide of iron, in the same manner as the specimen upon which was established the *Felis atrox*,† and which was found in the same locality.

PROCYON PRISCUS, Le Conte. Amer. Jour. Sci. and Arts, 2d s. v, 106.

This species of extinct raccoon was first indicated by Dr. John L. Le Conte, from some specimens which were found in association with remains of several animals of

\* Journ. Acad. Nat. Sc., vi, 269.

Med. and Phys. Res., 329, pl. xiv, fig. 26.

† Trans. Am. Phil. Soc., 2d ser. x, pl. 34.

the peccary tribe, *Platygonus compressus*, *Protochaerus prismaticus*, &c., in the lead region of the vicinity of Galena, Illinois.

Besides several phalanges, the fossil specimens alluded to consist of several fragments of jaws and teeth.

A small fragment of the upper jaw (figure 17, plate 17) of the left side contains the fourth and fifth molars, which have the same form as the corresponding teeth of *Procyon lotor*, but are about one sixth larger.

A specimen of a right upper canine tooth has the same size as in the recent raccoon, but is rather less compressed towards the subacute borders of the crown. (Figure 24, plate 17.)

A small fragment of the right side of a lower jaw, (fig. 19,) rather larger than the corresponding portion of the same bone in the recent raccoon, contains the canine and the fourth molar tooth. The former has the same form, as in the recent raccoon, and is only a little larger. The latter tooth is not only larger than its representative in the recent raccoon; but it has the inner posterior ridge of the crown continuous with the principal cusp and not terminating in a small cusp, and the tubercle at the outer posterior part of the base of the principal cusp is hardly developed in comparison with its condition in the recent raccoon. (Figs. 19, 20, 21.)

An apparent, isolated, inferior, third molar tooth (figs. 22, 23) of the left side has more nearly the form of the fourth one than of its homologue in the recent raccoon, and it is also relatively larger in comparison with its associated succeeding tooth than in the latter species. The principal cusp and that developed from its base postero-externally are more distinctly separated than in the corresponding points of the fourth molar of the recent raccoon. The anterior heel also is less developed and that posteriorly is less excavated than in the succeeding tooth of the recent raccoon, with which it is compared in preference to the corresponding one of the latter species. The size and form of the two fangs of the fossil tooth correspond with the same characters of the two alveoli for the third molar in the fragment of a lower jaw above indicated. In conclusion it must be admitted that had this last described tooth been found alone it would without hesitation have been viewed as a third inferior molar of *Procyon lotor*. (Figure 22, plate 17.)

Plate 17, fig. 17.—Outer view of the superior fourth and fifth molars of the right side of *Procyon priscus*.

fig. 18.—View of the triturating surfaces of the same teeth.

fig. 19.—Fragment of the lower jaw of the right side containing the canine and the fourth molar.

fig. 20.—View of the triturating surface of the latter tooth.

fig. 21.—Inner view of the same tooth.

fig. 22.—Outer view of the left inferior third molar.

fig. 23.—View of the triturating surface of the latter tooth.

fig. 24.—Outer view of the right superior canine.

ANOMODON SNYDERI, Le Conte. Am. Journ. of Science and Arts, 2d ser. v, 106.

In association with the remains of *Procyon priscus*, just described, there was found a curious tooth, which Dr. Le Conte has supposed to be the left superior canine of a large insectivorous animal. It is quite peculiar in form; and its affinities I am at present unable to determine.

The tooth is compressed to a remarkable degree, and on the inner side for the greater part of its length is depressed, so that a transverse section except near the apex of the crown would be reniform. The crown is curved conical, and is most convex externally. Posteriorly its outer and inner surfaces are separated by a feeble ridge; and internally about half way towards the base it is furnished with an anterior and a posterior tubercle, of which the former is lower than the other.

The fang at the broken border of the specimen is nearly half an inch broad and is less than two lines thick. In consequence of the depression of its inner wall, the pulp cavity has a curved linear form, thus (.

In its perfect condition the tooth has apparently been in the neighborhood of an inch and a half long, and the base of the crown measures five lines broad and one and three quarter lines thick.

Plate 17, fig. 25.—Outer view of tooth of *Anomodon Snyderi*.

fig. 26.—Inner view of the same tooth.



ART. XV.—*On the Sandstone Fossils of Connecticut River.*

BY JAMES DEANE, M. D.

Prior to the year 1835, the indications of organic life, co-existing with the sandstone deposition of Connecticut River, were exclusively confined to a few genera of heterocercal fishes. This rock was formerly supposed to be so destitute of animal remains, that when in this year I opened a new chapter of its organic history, my discoveries were treated with incredulity and neglect. But, after the investigations of twenty years that have resulted, it is known to be exceedingly rich in the imperishable materials of geological history. Very few indeed have any conception of the marvellous perfection of these fossil inscriptions, or of the multitudes of once living creatures whose existence they commemorate. During the vast sandstone deposition, it is presumed that animals whose instincts and organizations attracted them to littoral margins, were as numerous as their living representatives. The immense groups of birds embraced countless individuals who have inscribed upon the shores whereon they congregated their unmistakeable and instructive history. Most of the finest impressions have never been described, and the rich discoveries of late years, render a thorough revision of these fossils indispensable to a clear comprehension of the sublime truths they teach.

Other inferior creatures existed in astonishing profusion during the sandstone period, and like the birds, have left the imprints of their feet vivid as upon the day they were made. The presumption is that they embraced as a class, animals no higher in the scale of organization than vertebrated reptiles. They were quadrupedal, and were grouped into several orders; Saurians, Batrachians and Chelonians. Of the saurian and batrachian orders I am acquainted with twenty species at least, and shall present herewith a notice of ten of that number. In one essential feature all these impressions concur, and that is, in the difference in magnitude between the anterior and posterior feet, the latter being about four times greater than the former. This distinctive character, and the diminutive size of the animals they indicate, appear to distinguish them into species, having their affinities in existing salamandrian or tailed Batrachians.

The indications of Tortoises prove them to have been very numerous, but it is nearly impossible to detect specific differences. Their movements over soft mud resulted in ploughing up a trace or furrow by the solid armor of their bodies. In some instances the swinging movements of their feet are well preserved, and in rare cases the pedal imprints are also visible.

Descending in the scale of organization, this rock has retained the foot-print of insects and crustacea with surprizing fidelity. Nothing in the strange history of the sandstone fossils, is more astonishing than the unrivalled perfection of the vestiges of these frail creatures.

In this brief memoir I shall endeavor to portray some of these interesting hieroglyphics of extinct existences. Fig. *c*, pl. 18, is an unimpeachable footprint of a bird, no other animal could impress it. Its analogies are unmistakeable. It is a left foot, the inner toe has two, the middle three, and outer four phalanges, exclusive of the nail, which is in exact correspondence with the feet of existing trydactylous birds. The triple-headed, or distal extremity of the tarso-metatarsal bone, is also unequivocally impressed. Naturalists may, if they prefer it, explain the origin of these impressions upon the hypothetical existence of such monsters as biped reptiles, but by the unerring laws of comparison, I have never hesitated for a moment to ascribe these footprints to birds. In this opinion I am sustained by a distinguished comparative anatomist, who, in relation to fig. *c*, remarks, "that some naturalists would call it reptilian, because, according to their idea of cosmogony, birds did not exist in the new red sandstone period, and there are some very distinguished naturalists who maintain this doctrine, but I call it the footprint of a bird, cosmogony or no cosmogony."

Fig. *a* is quadrupedal, and is Batrachian. Each foot has four toes radiating forward, and the anterior foot is considerably more advanced than is usual. This is a very beautiful specimen of these delicate footprints.

Fig. *d* has four toes, two diverging outward and two inward. They are thick and somewhat massive, and blunt at their extremity. Both the anterior and posterior feet are analogous as to form.

Fig. *e* is an elegant and interesting example of the quadrupedal impressions, and the most diminutive ever seen. It is very perfect, yet it is difficult to comprehend the place to which the animal who made them should be assigned. All the other quadrupeds move by alternate steps, but in this example both right and left feet fall simultaneously. There is no impression of a fore foot, but this is a common defect in delicate quadrupedal impressions, the impression of the fore foot not always being retained. It may be that the imprint of the anterior foot is obliterated by that of the posterior foot. The dragging of the foot from one step to another is distinctly preserved. There were probably four toes. The surface upon which the creature moved is smooth as if polished, and no other would retain the imprints with such extraordinary fidelity.

Fig. *b* is probably Saurian. It is exceedingly perfect. It is a hind foot with five heavy toes, if the appendage upon the left be considered as a toe. It has a Chirotherian aspect, but as it is a solitary example, and is separated from the fore foot, its true relations cannot be exactly determined. The fine preservation of its massive heel and toes renders it a very beautiful example of foot prints.

Fig. *a*, diagram A, pl. 20, is an undescribed species of quadrupedal imprints. The foot-prints are defective, being impressed when the mud was too soft to retain forms, but this condition was favorable to receive the trail of the animal's tail, which is exquisitely preserved. This is a rare feature.

Fig. *b*, diagram A, pl. 20, is likewise new and undescribed, and is remarkable for the disparity of the anterior and posterior feet. The fore feet are very perfect, four thick but pointed toes radiate outward and somewhat backward. The posterior feet are comprised of four long, slender toes, lying nearly parallel, and the feet are divergent. Right and left feet widely separated.

The foregoing species of quadrupedal imprints have never been figured or described. Those which follow are copied from drawings made by myself and published in the Journal of the American Academy of Arts and Sciences a few years since. They are inserted here for comparison, although a simple outline of a foot can convey no adequate idea of its organization.

Fig. *a*, diagram B, pl. 20, is remarkable for its peculiar symmetry. Four thick, tapering toes radiate forward, and in the hind foot the impression of the heel is prolonged backward to a considerable distance, and is broad and flattened. The fore foot is planted a little in advance and a little outward of the hind foot.

Fig. *b*, diagram B, pl. 20. The hind foot consists of three thick, pointed toes, widely spread, and a short toe pointing inward. The heel is projected backward, and terminates in a rounded extremity. The anterior foot is not conformable to the posterior. Four toes, two pointing forward and outward, and two outward and backward. In birds the foot points inward without exception; in quadrupedal impressions it diverges outward in every instance I have ever seen except this. The hind foot inclines slightly inward. Both examples upon diagram B are exquisitely beautiful and perfect.

Fig. *a*, diagram C, pl. 20, is a series of very delicate foot-prints. Toes four, long and slender, and drag from one step to another. Impression of anterior feet not retained.

Fig. *b*, diagram C, pl. 20, is probably Saurian. Toes have a chirotherian look, thick and massive. Feet divergent. The fore foot planted near the hind, sometimes partially obliterated by it. Stride very great. Fig. *d*, diagram C, is probably analogous, and both, with the exception of the appendage upon the side opposite the thumb, have a striking resemblance to fig. *b*, pl. 18.

The remaining fig. *c*, diagram C, pl. 20, is probably Batrachian; toes four, feet divergent, impressions of anterior feet not retained.

The impressions upon pl. 19 are of recent discovery, and the obscurity of their origin is in proportion to their beauty and extraordinary preservation. Nothing of the kind has hitherto been described or even discovered.

Fig. *a* of this plate is remarkable for the geometrical symmetry and perfection of the dotted impressions, which are arranged in divisions, each a reproduction of the other.



I think in the present state of science it is impossible to explain the origin of this elegant fossil. If the acuminate bodies that constitute the various lines of impressions be not due to the deciduous fronds of plants, they must be taken for the dermoid protuberances of some animal. There is not the slightest evidence of a compressed stem of a coniferous or other plant, which should certainly be the case in so perfect a specimen; and moreover, upon the superior or superincumbent stratum, the imprint is reversed; it is a cast, and this, it appears to me, is conclusive evidence against a vegetable origin. I have drawn this beautiful fossil with excessive care, for it is the most difficult puzzle I have ever encountered, and I must leave it to others more competent than myself to determine its origin. The reader who will take the trouble to analyze the various line of impressions, will find a corresponding number in each repetition. Thus in the unbroken row running obliquely upward from left to right, there are invariably fourteen of the protuberant points, and in each other line, when repeated, is consistent, both as to number and arrangement of the geometrical lines of elevations.

The remaining figures upon this plate are probably foot-prints of a class of creatures not higher in the scale of organization than the articulated division of animals, and a few observations perhaps may assist in deciding upon their origin. I rely more upon the fidelity of the drawing than upon any descriptions to convey exact ideas.

Fig. *l*, pl. 19, is the simplest form of these linear imprints. It is a single set of straight, slender, parallel feet, planted in regular succession.

Fig. *f*. The set is also single, feet slightly divergent, and terminate in an enlargement or depression, caused apparently by the momentum by which the creature moved.

Fig. *c*. The two rows upon the left are identical with those of fig. *f*, but there is also an additional row of impressions upon the right, the terminations of which are not excavated.

In fig. *b* the impressions are identical with fig. *c*, except that the order is reversed.

In fig. *h* two sets of feet are exquisitely preserved. The irregular or odd number of feet may perhaps be explained upon the hypothesis that the creature was moving upon the bottom of the water, and by floating used a part only of its organs of locomotion. This conjecture is sustained by the fact that the rows of impressions sometimes appear and disappear abruptly upon the surface, and are both preceded and succeeded by delicate prolonged lines, caused by dragging of the feet.

Fig. *g* displays two rows of linear feet, and are very fine indeed. The entire length of the original impressions is fifteen inches.

Fig. *k* shows a row of parallel linear feet, and corresponding rows of lateral bulbous impressions.

Fig. *d* also shows the central or parallel rows, and two corresponding lateral rows of curved feet.

Fig. *e* exhibits the trail of the body, with lateral feet.

These extraordinary fossils occur upon surfaces as smooth as polished marble; no other would receive, much less retain such delicate impressions with such fidelity. To explain their obscure meaning I have sought the assistance of several gentlemen distinguished for their scientific attainments, and it gives me pleasure to subjoin their opinions to these meagre descriptions of my own.

Prof. Leidy considers the impressions *k*, *d*, *i*, *f*, *c*, and *b*, to be the tracks of insects and crustacea; *g* and *e* those of worms; and *a*, from its remarkable uniformity, to be rather a vegetable than an animal impression.

Prof. Gray is of opinion that fig. *a* represents leaf scars of some plant like a tree fern.

Prof. Wyman is of opinion that fig. *a* is a vegetable impression, and that the other impressions upon this plate are due to articulate animals, insects or Crustaceans.

Prof. W. B. Rogers is of a similar opinion as regards fig. *a*, yet he remarks that this is but conjecture, and that we are without any guide as to what might be esteemed a probable interpretation of this mysterious inscription.

Prof. Dana can refer fig. *a* to nothing but a plant, the prominence being the traces of leaves, probably coniferous; still it is not like any known coniferous plant, ancient or modern. Upon the remaining figures of pl. 19 he offers the following valuable remarks: "The delicate linear tracks must be made by an articulate animal. They can hardly have been made by annelids (excepting *e* and *g* of which there is doubt), and may have been made by Crustaceans or insects, perhaps water insects. I should incline to say Crustaceans. Among the tribe of this class they may have been either Entomostracans, Isopods, Macrourans, or small species of Anomourans. Isopods have too small legs and pointed claws to make so large a track as *h*, and they would not make the two distinct series of this figure, or a track with three impressions as in *c*. The legs spread from the longitudinal axis, and do not point forward as in *l*. Still it is possible that *d* and *k* might have been made by an Isopod, the bent form of the track in this case being due to the fact that three joints of the leg, pressed on the mud in the progress of the animal. There is a small tribe of Crustaceans near the Isopods, which I have called *Anisopods*, in which the two anterior feet often have large claws, and are projected forward in front of the head, and such an animal might make marks with these claws like *l*, but I should think they would be likely to be less regularly, or even continuous lines."

"The Entomostracans may have been tracking the mud; but so small species of that group have usually very thin or slender feet, commonly more or less foliaceous for swimming."

"I should therefore be inclined to refer the triple and quadruple track to small Anomourans. The two more central tracks, where there are four, being made by the

anterior claws; and the one where there are three to the claw of one side, for it is very common for one claw to be larger than the other, and sometimes the difference of size is exceedingly great."

"I cannot say that *g* and *e* are Crustaceans, as some large Isopods have legs that would make as strong impressions. But in Isopods the three anterior of the seven pairs of legs are directed obliquely forward, and the four posterior pairs obliquely backward, so that there would hardly be with such animals the exact uniformity of direction these tracks present."

In bringing this paper to a conclusion, I must here express my acknowledgements to the gentlemen who have so politely responded to my request for information. I am also under peculiar obligations to Roswell Field, Esq., who is the discoverer of all the original specimens of the two plates and those of the diagram A, and who kindly loaned the specimen. The estate of Mr. Field is situated at Turner's Falls, and by his sagacity and activity he has been very successful in developing the history of these sandstone fossils. He has made many very splendid discoveries. The fossils that constitute the originals of the plates and diagrams are exclusively from Turner's Falls.

*Greenfield, March, 1856.*

ART. XVI.—PLANTÆ KANEANÆ GRŒNLANDICÆ. *Enumeration of Plants collected by Dr. E. K. Kane, U.S.N., in his first and second expeditions to the Polar Regions, with descriptions and remarks.*

BY ELIAS DURAND.

I have brought together in the following enumeration all the plants collected by Dr. Kane at the stations of his two voyages, the whole belonging to the western coast of Greenland, and nearly to the same geographical zone.

These stations were, for the first voyage, (1850 and 1851,) Sukkertoppen, Holsteinborg, Egedesminde, Disko, Upernavik, and Wolstenholm, between the 64th and 76th north parallels; and for the second, Fiske Fiord, Sukkertoppen, N. Proven, Upernavik and the different stations of Smith's Sound as far as 81° N. latitude.

The first collection was in pretty good order, but the second had suffered much from the peculiar hardships attending the last period of this eventful expedition, in which Dr. Kane's fortitude and devotion to science were so signally manifested. Surrounded with difficulties of every sort, and threatened by the impending danger of starvation and death, amid the drifts, disruptions and other impediments of a hyperborean climate, he did not hesitate sacrificing the useful articles of comfort and self-preservation, to make room in his luggage boxes for as many of his scientific collections as he could pack in them.

Thus was the best portion of his botanical specimens preserved to science, after suffering much, as it may be imagined, from the inclemency of the weather, and the hardships of a long and perilous voyage back to the United States. But for the zeal and self-denial of his comrades, and especially of his surgeon, Dr. I. I. Hayes, his co-laborer in the scientific field, Dr. Kane is pleased to acknowledge that he could never have undertaken their transportation.

Under these circumstances I have experienced great difficulty in determining several specimens,—difficulty arising not only from their damaged state, but also from their occasional incompleteness, some being just blooming, others in a fruiting condition, others again wanting some of the essential characters. To these disadvantages I must add the want, in several instances, of books of reference, and of authentic specimens for comparison.

When I attempted the task of determining these collections, I relied much, I confess, on the assistance of a learned and more experienced friend, Professor Asa Gray; but, owing to the pressure of his occupations, I have not been able to secure his valuable services to the extent of my anticipations. I am, however, greatly indebted to him for hints and remarks that have been very useful to me. I am under peculiar

obligations to Professor Torrey for the determination of the *Gramineæ*, and his assistance in some of the most perplexing genera; and also to my friend Thomas P. James, Esq., for the entire enumeration of mosses, *Hepaticæ* and Lichens. I am most happy to take this opportunity to render to these three gentlemen my sincere acknowledgments for their great kindness.

Laying aside the consideration of the lost packages, Dr. Kane's collections are yet among the richest and most interesting ever brought by Arctic and Polar explorers. They not only afford a considerable accession to our previous knowledge of the vegetation of Northern Greenland, but they develop facts of some importance in a physico-geographical point of view:—

First.—By exhibiting, throughout the range of coasts between the Arctic and Polar circles, no perceptible change in the number and identity of the species therein collected; thus establishing, as far at least as Greenland is concerned, that the third or Polar zone of Sir John Richardson\* might as well begin at the 67th as at the 73d N. latitude.

Secondly.—By the reappearance, beyond the limits of Smith's Sound, of *Hesperis Pallasii* and *Vesicaria arctica*, in a perfect fruiting state—two plants belonging rather to the milder regions of the Arctic zone, and which have never been found yet, I believe, in the higher intervening points. Both these plants belonged to a scanty collection of eight or ten species, made late in the season, on the newly discovered lands of Washington and Humboldt, on the very verge of that mysterious Polar sea which Dr. Kane's expedition had the good fortune to espy and see free of ice as far as the eye could reach. Such a fact indeed, although limited to two species, seems to indicate peculiar isothermal influences, depending either on warm currents, greater depth of water, or actual depression of our globe at its poles.

Another remarkable feature of Dr. Kane's collections is, that, dividing into two equal parts the whole extent of coasts visited by him, and each section presenting about the same number of stations at which herborizations were made, the northern section, from Upernavik to Washington Land, has yielded more dicotyledonous plants than the southern, from Fiske Fiord to 73°; and Smith's Sound alone, only three degrees in length, has proved nearly as rich. (See Table No. 1.)

These unexpected results show that the Polar zone cannot properly be compared with the Alpine regions of the more temperate climates. The uninterrupted action of light and heat, during the whole period between the rising and setting of the sun, which marks the day or summer season of the poles,—a purer and damper atmosphere, aided, perhaps, by a greater accumulation of electric fluid, &c.—must necessarily and more promptly (in the lowest levels) actuate and perfect the vegetation, not only of

\* See Appendix to Searching Expedition, London, 1851, p. 319 and following.

plants inured to those climates, but also of those the seeds of which have been transported hither from milder regions by currents, migration of birds, or other causes. Unlike the snow-capped and barren summits of the Alpine regions, at all times destitute of verdure, it is probable that vegetation is permitted to extend to the very pole itself, wherever it meets with proper soil, favorable solar exposure, and protection from the blasts of winds.

The southern extremity of Greenland, from Cape Farewell to Sukkertoppen, has been well explored, and found to possess nearly the same climate as Labrador, with an almost identical vegetation. E. Meyer, in his *Plantæ Labradoricæ*, (1830,) enumerates 224 phænogamous species, the greater part of which are indigenous both to Labrador and to Greenland. Professor Giesecke, who resided several years in Greenland, for the express purpose of studying its Natural History, published in Brewster's Edinburgh Encyclopedia (1832) an enumeration of 171 phænogamous species, with a long list of Cryptogams, amounting to no less than 231 species, all indigenous to that island. From the two above works, and from all the other sources to which I have had access,—De Candolle, Torrey and Gray, Hooker, Brown, Richardson, Hornemann, Steudel,—for Cyperaceæ and Gramineæ, &c., I have compiled the following Table No. 2, which presents an amount of 264 phænogamous species, belonging to 109 genera and 36 families.

This apparent richness of the Greenland flora is, however, confined to the extreme southern point of the island; for, from Sukkertoppen to a few degrees higher, it is found to have lost already eight or ten families; and from Upernavik, 73°, to the outlet of Smith's Sound, it is reduced to twenty families, by the entire disappearance of *Violaceæ*, *Oxalidaceæ*, *Holorageæ*, *Umbellifereæ*, *Cornaceæ*, *Lentibulaceæ*, *Primulaceæ*, *Gentianaceæ*, *Boraginaceæ*, *Labiataæ*, *Plumbaginaceæ*, *Plantaginaceæ*, *Betulaceæ*, *Conifereæ*, *Orchidaceæ*, and *Melanthaceæ*.

Notwithstanding this prodigious decrease, the column headed North Greenland from 73°, in Sir John Richardson's Statistical Tables, will be found, by the accession of 27 other species from Dr. Kane's collections, now to be raised—from 49 phænogamous species allotted to that region by the eminent English botanist—to 76; which is a gain of fifty per cent.

The following species are to be added to Richardson's column of North Greenland from 73°:—

Ranunculus Sabinii?	Dryas octopetala.	Hieracium vulgatum.	1 Salix.
Hesperis Pallasii.	Alchemilla vulgaris.	Vaccinium uliginosum	2 Eriophorum.
Vesicaria arctica.	Potentilla frigida.	Pyrola chlorantha.	Agrostis canina.
3 Draba.	Sedum rhodiola.	Diapensia Lapponica.	Festuca ovina.
Arenaria arctica.	2 Saxifraga.	2 Pedicularis.	27
Cerastium, N. Sp.?	Gnaphalium sylvaticum.	Empetrum nigrum.	

Only two new species, *Pedicularis Kanei* and *Bryum lucidum*, have been found in the whole collections.

TABLE No. 1.

*Enumeration of the Phænogamous plants collected by Dr. E. K. Kane, on the western coast of Greenland.*

DICOTYLEDONOUS PLANTS.		From 64—73°.	From 73—80°.	DICOTYLEDONOUS PLANTS.		From 64—73°.	From 73—80°.
I. RANUNCULACEÆ.				V. ROSACEÆ.			
1.	Ranunculus aquatilis, var. Dur.	*	*	28.	Dryas octopetala, L.	*	*
2.	" glacialis, L.	*	*	29.	" integrifolia, Vahl.	*	*
3.	" nivalis, α. L.	*	*	30.	Alchemilla vulgaris, L.	*	*
	" " β. Br.	*	*	31.	" alpina, L.	*	*
4.	" aff. sabinii ?	*	*	32.	Potentilla pulchella, Br.	*	*
II. PAPAVERACEÆ.				33.	" nivea, α. fl. D.	*	*
5.	Papaver nudicaule, L.	*	*		" " β. H.	*	*
III. CRUCIFERÆ.					" " γ. T. & G.	*	*
6.	Arabis alpina, L.	*	*	34.	" frigida, Vill. A. Gr.	*	*
7.	Cardamine pratensis, var. H.	*	*	35.	" aurea, β. D. C.	*	*
8.	Hesperis Pallasii, T. & Gr.	*	*	36.	" tridentata, Ait.	*	*
9.	Vesicaria arctica, α. H.	*	*	VI. ONAGRACEÆ.			
10.	Draba alpina, α. H.	*	*	37.	Epilobium angustifolium, L.	*	*
	" " β. B.	*	*	38.	" latifolium, L.	*	*
	" " corymbosa.	*	*	VII. CRASSULACEÆ.			
	" " micropetala.	*	*	39.	Sedum rhodiola, D. C.	*	*
	" " var.	*	*	VIII. SAXIFRAGACEÆ.			
11.	" glacialis, β. H.	*	*	40.	Saxifraga oppositifolia, L.	*	*
12.	" rupestris, α. Br.	*	*	41.	" flagellaris, Willd.	*	*
13.	" nivalis, Willd.	*	*	42.	" aizoides, Wahl.	*	*
14.	" Lapponica, Willd.	*	*	43.	" tricuspidata, Retz.	*	*
15.	" hirta, L.	*	*	44.	" cœspitosa, α. L.	*	*
16.	" incana, var. confusa, T. & Gr.	*	*		" " β. H.	*	*
17.	Cochlearia fenestrata, Br.	*	*	45.	" aizoon, Jacq.	*	*
18.	" officinalis, L.	*	*	46.	" nivalis, L. α.	*	*
19.	" Anglica.	*	*		" " β.	*	*
IV. CARYOPHYLLACEÆ.				47.	" foliolosa, Br.	*	*
20.	Arenaria Grœnlandica, Spr.	*	*	48.	" cernua, L.	*	*
21.	" arctica, var. H.	*	*	49.	" rivularis.	*	*
22.	Stellaria humifusa, Rottb.	*	*	IX. COMPOSITÆ.			
23.	" longipes, var. β. minor H.	*	*	50.	Gnaphalium sylvaticum, L.	*	*
	" " δ. T. & Gr.	*	*	51.	Hieracium vulgatum, Fries.	*	*
	" " ε. T. & Gr.	*	*	52.	Arnica angustifolia, Vahl.	*	*
24.	Cerastium alpinum, α. L.	*	*	53.	Taraxacum palustre, D. C.	*	*
	" " β. Fischerianum, T. & Gr.	*	*	X. CAMPANULACEÆ.			
	" " δ. uniflorum, D.	*	*	54.	Campanula linifolia, A. D.	*	*
	" " var.	*	*	55.	" uniflora, L.	*	*
25.	Silene acaulis.	*	*	XI. ERICACEÆ.			
26.	Lychnis apetala, α. L.	*	*	56.	Vaccinium uliginosum, L.	*	*
	" " β.	*	*				
27.	" alpina, L.	*	*				



TABLE No. 1.—Continued.

DICOTYLEDONOUS PLANTS.	From 64—73°.	From 73—80°.	MONOCOTYLEDONOUS PLANTS.	From 64—73°.	From 73—80°.
57. <i>Cassiope tetragona</i> , L.	*	*	XX. ORCHIDACEÆ.		
58. <i>Phyllocece taxifolia</i> , Salisb.	*	*	78. <i>Platanthera hyperborea</i> , Lindl.	*	
59. <i>Rhododendron Lapponicum</i> , Wahl.	*	*	XXI. MELANTHACEÆ.		
60. <i>Loiseleuria procumbens</i> , Desv.	*	*	79. <i>Tofieldia palustris</i> , Huds.	*	
61. <i>Ledum palustre</i> , L.	*	*	XXII. JUNCACEÆ.		
62. <i>Pyrola chlorantha</i> , Sw.	*	*	80. <i>Luzula spicata</i> , Desv.	*	
XII. BORAGINACEÆ.			81. " <i>hyperborea</i> , Br.	*	*
63. <i>Mertensia maritima</i> , Don.	*		82. " <i>arcuata</i> , Mey.	*	*
XIII. SCROPHULARIACEÆ.			83. <i>Juncus trifidus</i> , Fl. Dan.	*	
64. <i>Bartsia alpina</i> , L.	*	*	84. " <i>arcticus</i> , L.	*	
65. <i>Pedicularis arctica</i> , Br.	*	*	XXIII. CYPERACEÆ.		
66. " <i>Kanei</i> , D.	*	*	85. <i>Carex rigida</i> , Good.	*	*
67. " <i>hirsuta</i> , L.	*	*	86. " <i>dioica</i> , L.	*	*
XIV. LABIATÆ.			87. " <i>aff. retroflexa</i> ?	*	*
68. <i>Thymus serpyllum</i> , var.	*		88. <i>Scirpus cespitosus</i> , L.	*	*
XV. DIAPENSIACEÆ.			89. <i>Eriophorum capitatum</i> , Host.	*	*
69. <i>Diapensia Lapponica</i> , L.	*		90. " <i>vaginatum</i> , L.	*	*
XVI. POLYGONACEÆ.			91. " <i>polystachyon</i> , L.	*	*
70. <i>Polygonum viviparum</i> , L.	*	*	XXIV. GRAMINEÆ.		
71. <i>Oxyria digyna</i> , Campd.	*	*	92. <i>Alopecurus alpinus</i> , Engl. Bot.	*	*
XVII. EMPETRACEÆ.			93. <i>Phippsia algida</i> , B.	*	*
72. <i>Empetrum nigrum</i> , L.	*	*	94. <i>Agrostis canina</i> , B.	*	*
XVIII. BETULACEÆ.			95. <i>Calamagrostis canadensis</i> , Beauv.	*	*
73. <i>Betula nana</i> , L.	*		96. " <i>stricta</i> , Nutt.	*	*
XIX. SALICACEÆ.			97. <i>Glyceria arctica</i> , H.	*	*
74. <i>Salix desertorum</i> , Rich.	*	*	98. <i>Catabrosa aquatica</i> , Beauv.	*	*
75. " <i>uva-ursi</i> , Pursh.	*	*	99. <i>Poa arctica</i> .	*	*
76. " <i>arctica</i> , Br.	*	*	100. " <i>alpina</i> , L.	*	*
77. " <i>herbacea</i> , L.	*	*	101. <i>Festuca ovina</i> ,	*	*
			102. " <i>Richardsonii</i> ? H.	*	*
			103. <i>Bromus Kalmii</i> ? Torr.	*	*
			104. <i>Elymus arenaria</i> , L.	*	*
			105. <i>Aira flexuosa</i> , L.	*	*
			106. <i>Trisetum subspicatum</i> , Palis.	*	*

TABLE No. 2.

GENERAL FLORA OF GREENLAND.			PRESENT FLORA OF NORTH GREENLAND, FROM 73°.			
Phænogamous Families.	Genera.	Species.	Phænogamous Families.	Genera.	Species.	Gain by the acces- sion of the Kanean Plants.
1. Ranunculaceæ.	4	12	1. Ranunculaceæ.	1	2	1
2. Papaveraceæ.	1	1	2. Papaveraceæ.	1	1	
3. Cruciferae.	8	22	3. Cruciferae.	6	12	5
4. Violaceæ.	1	2				
5. Caryophyllaceæ.	6	21	4. Caryophyllaceæ.	5	9	2
6. Oxalidaceæ.	1	1				
7. Leguminosæ.	4	4	5. Leguminosæ.	1	1	
8. Rosaceæ.	7	18	6. Rosaceæ.	3	7	3
9. Onagraceæ.	1	4	7. Onagraceæ.	1	2	
10. Holorageæ.	1	1				
11. Crassulaceæ.	1	2	8. Crassulaceæ.	1	1	1
12. Saxifragaceæ.	1	18	9. Saxifragaceæ.	1	9	2
13. Umbelliferae.	2	2				
14. Cornaceæ.	1	1				
15. Compositæ.	10	18	10. Compositæ.	5	5	2
16. Campanulaceæ.	1	3	11. Campanulaceæ.	1	1	
17. Ericaceæ.	10	19	12. Ericaceæ.	3	3	2
18. Lentibulaceæ.	1	2				
19. Primulaceæ.	1	2				
20. Gentianaceæ.	2	4				
21. Diapensiaceæ.	1	1	13. Diapensiaceæ.	1	1	1
22. Boraginaceæ.	1	1				
23. Scrophulariaceæ.	5	12	14. Scrophulariaceæ.	1	3	2
24. Labiatae.	2	2				
25. Plumbaginaceæ.	1	2				
26. Plantaginaceæ.	1	1				
27. Polygonaceæ.	4	7	15. Polygonaceæ.	2	2	
28. Empetraceæ.	1	1	16. Empetraceæ.	1	1	1
29. Betulaceæ.	2	3				
30. Salicaceæ.	1	10	17. Salicaceæ.	1	4	1
31. Coniferae.	1	1				
32. Orchidaceæ.	2	3				
33. Melanthaceæ.	2	3				
34. Juncaceæ.	2	11	18. Juncaceæ.	1	2	
35. Cyperaceæ.	3	17	19. Cyperaceæ.	2	3	2
36. Gramineæ.	16	32	20. Gramineæ.	6	7	2
36 Phænogamous Families.	109	264	20 Phænogamous Families.	44	76	27

## ADDENDA AND CORRIGENDA.

Page 185, line 8. After the parenthesis add: and undoubtedly *R. hederaceo proximus* of Giesecke.

Page 190, third line from bottom. Cancel *P. nana?* and what follows, and read: *P. frigida*, Villars in D. C. Prodr. ii. p. 572. Lam. Dict. Encycl. v. p. 602. A. Gray, Man., ed 2d.

Page 195, line 13th from the bottom. Lunatus, read lanatus.

Page 198, line 10. Melianthaceæ, read Melanthaceæ.

## ENUMERATION.—DICOTYLEDONOUS PLANTS.

## RANUNCULACÆ.

1. *RANUNCULUS AQUATILIS*, var. *arcticus*. Foliis omnibus emersis, consimilibus, profunde tripartitis; partitionibus cuneatis, ad marginem dilatatis, crenatis; flore albo; sepalis ovalibus, concavis, petala fere æquantibus.

This form, of which I have only two specimens, has a great affinity with De Candolle's *R. aquatilis*, var. *hederaceus*, *R. hederaceus*, Lam., not of Linn. (vide Fl. Franç. vol. 4, p. 894.) The stems are fistulous repent, with small fascicles of radical fibres at each node below the scape. No capillaceo-multifid leaves; they are all suborbicular tripartite, on long vaginant petioles, 3—4 at the base of each peduncle; leaflets cuneate, with dilated crenate margins, each crenature having a blunt mucro. Scape thick, naked, one-flowered, 3—3½ inches high. Flower white, middle size, with five oval and concave sepals about the length of the petals.

Disko and adjacent coast, 70°.

2. *R. GLACIALIS*, Linn., sp. plant. p. 777. D. C. Prodr. 1, p. 30. Torr. and Gr. 1, p. 16.

North Proven, 72°.

3. *R. NIVALIS*, Linn., Fl. Lapp., p. 158—T. 8. D. C. Prodr. 1, p. 35. Hook, Fl. Bor. Am. 1, p. 17. Torr. and Gr. 1, p. 20.

α. *R. nivalis* Linn. Leaves glabrous, on long ciliate petioles, somewhat reniform, crenato-lobate, lobes obtuse, more or less deep, equal or narrower at base, with conspicuous divergent veins. Cauline leaves sessile, palmate. Flowers rather large, deep yellow; petals oval-rounded, about twice the length of the calyx which, as well as the peduncle, is covered with a thick, brown toment. Root perpendicular, with numerous white and thick fibres, indicating a plant deeply rooted in mossy beds.

Stations of Smith's Sound, 78°—80°.

β. *R. Br.*, in Parry's first voy. app., p. 264. *R. nivalis*, var. Vahl., Fl. Lapp, p. 157. *R. sulphureus*, Soland. in Phipps' Voy., p. 202. Leaves cuneate, palmately lobed, lobes generally narrower at base. Flower pale yellow.

Smith's Sound Stations, 78°—80°.

4. . . . . I have two very damaged specimens, closely allied, by the leaves, with the preceding variety, but widely different on other points, and which might be *R. sabinii*, *R. Br.*, collected on the shores of Melville Island in Parry's first voyage. The radical leaves are cuneate, veined, ciliate, deeply 3-parted, with lateral partitions bifid, supported on long vaginant membranaceous petioles. Stem apparently two-flowered. Flowers pale yellow, smaller than the preceding. Sepals and peduncles

covered with whitish hair. Petals partly destroyed, but seemingly narrower than in the above species.

Grows in dry levels at Bedivelled Reach, 79°.

#### PAPAVERACEÆ.

5. PAPAVER NUDICAULE, Linn., spec. pl. p. 725. Fl. Dan. T. 41. Pursh's Fl., p. 364, &c. The most hardy plant of the polar regions, resisting the first frosts and remaining the last in flower. The leaves and especially the seeds, which are very oleaginous, are a great resort in scorbutic affections and agreeable to the taste. Dr. Kane.

This plant was found at all the stations of the two voyages, and extends probably to the farthest limits of vegetation.

#### CRUCIFERÆ.

6. ARABIS ALPINA, Linn., Fl. Dan. T. 62. Pursh's Fl., p. 427. Torr. and Gr. 1, p. 80.

North Proven, 72°.

7. CARDAMINE PRATENSIS, *β. angustifolia*, Hook., Fl. Bor. Am. 1, p. 45.

Sukkertoppen, 64°; Disko, 70°.

8. HESPERIS PALLASII, Torr. and Gr. suppl., p. 667. *H. minima*, Torr. and Gr. 1, p. 90. *H. pygmæa*, Hook. Fl. Bor. Am. 1, p. 60. *Cheiranthus Pallasii*, Pursh's Fl., p. 436. *C. pygmæus*, Adans. in D. C. prodr. 1, p. 137. Two fruiting specimens 4—6 inches high, scarcely to be mistaken from Dr. Hooker's fig. T. 19 of Fl. Bor. Am. Leaves only apparently narrower by drying. Found at the extreme north point of Dr. Kane's expedition, on Washington Land, 81st N. latitude. This plant was discovered by Pallas on the north-west coast of America, and never, I believe, in the Arctic Sea.

9. VESICARIA ARCTICA, *α.* Hook. Fl. Bor. Am. 1, p. 48. Rich. in Frankl. 1st jour. ed. 2d app., p. 20. *Alyssum arcticum*, Fl. Dan. T. 1526. Torr. and Gr. 1, p. 100.

Fruiting specimens found, August 27, at the junction of Humboldt and Washington Lands, 81st N. latitude.

10. DRABA ALPINA, *α.* Hook. Fl. Bor. Am. 1, p. 50. *D. alpina*, Linn's Herb. ex R. Br. Torr. and Gr. 1, p. 103. Silicles glabrous; flowers yellow; leaves less hairy than var. *β.* Just flowering, and of smaller size than fig. in T. 56 in Fl. Dan.

North Proven, 72°.

*β.* R. Br. Spitzb., pl. in Scoresby's Arct. Reg. Hook. Fl. Bor. Am. 1, p. 50. Torr. and Gr. 1, p. 103. Leaves, peduncles and silicles hairy. Flowers rather larger than the preceding, and of a deeper yellow color.

Rensselaer Harbor, 79°.

Var. *corymbosa*. Densely cespitose, and perhaps the same as the following. Scapes short, naked, almost glabrous as well as the silicles. Flowers apparently white and quite corymbose. Style rather long, stigma emarginate. Perhaps var.  $\delta$ , Hook, or *D. corymbosa*, R. Br. in Ross' Voy., but scarcely to be separated from *alpina*.

Bedivelled Reach, 78°.

Var. *micropetala*. Leaves larger than the preceding varieties and retaining a lively green color in the dry state, ciliate, but scarcely hispid on the surface. Scape, short, naked, pilose, as well as the calyx. Just blooming; flowers white, small, thickly corymbose and almost capitate. Perhaps *D. micropetala*, Hook. in Parry's 2d voy. app., p. 385. Torr. and Gr. 1, p. 104, but scarcely anything more than another form of *D. alpina*.

North Proven, 72°, and Rensselaer Harbor, 79°.

. . . . . Another variety in the fruiting state, with scape naked,  $3\frac{1}{2}$  inches high; silicles corymbose, oval, much larger than in the other varieties and conspicuously veined, very hairy, as well as the scape and pedicles. Style short, with a blunt stigma.

Rensselaer Harbor, 79°, August 27.

11. *D. GLACIALIS*,  $\beta$ . Hook. Fl. Bor. Am. 1, p. 51. Scapes and pedicles pubescent; silicles glabrous, with the habits of var.  $\epsilon$ .

Disko and below Bedivelled Reach, 70° and 78°.

12. *D. RUPESTRIS*,  $\alpha$ . R. Br. in Hort. Kew. 3, p. 91. D. C. Prodr. 1, p. 169. *D. hirta*, Engl. Bot. T. 1338. *D. hirta*, var. 4, Hook. in Parry's 2d voy. app. p. 386. Pubescent; scapes naked, or with a 3-cleft leaf about the middle.

Rensselaer Harbor, 79°, August 27.

13. *D. NIVALIS*, Willd. *D. rupestris*,  $\beta$ . Torr. and Gr. 1, p. 105. Leaves rosulate, scarcely linear oblong, but otherwise according with Willdenow's description. Scapes 6—7 inches high, hirsute, with a small leaf below the middle. Silicles glabrous.

14. *D. LAPPONICA* ? Willd. D. C. Prodr. 1, p. 169. R. Br. in Parry's 1st voy. app., p. 266. *D. hirta*, var. 3, in Parry's 2d voy. Torr. and Gr. 1, p. 105. Specimens in the fruiting state; scape naked, almost glabrous, as well as the lanceolate entire leaves.

Disko Island, 70°.

15. *D. HIRTA*, Linn. Scape and silicles puberulent-pilose. Radical leaves entire, oval-lanceolate; those of the scape toothed. Flowers rather large, white, racemose; silicles oval-oblong; style scarcely any.

Upernavik, 73°.

16. *D. INCANA*, var. *confusa*, Torr. and Gr. 1, p. 107. *D. incana*, var. Linn. *D. confusa*, Ehrh. in D. C. Prodr. 1, p. 170.

Fiske Fiord, 64°.

17. *COCHLEARIA FENESTRATA*, R. Br. in Ross' voy. ed. 2d, vol. 2, p. 193, and in Parry's 1st voy. app., p. 266. Torr. and Gr. 1, p. 109. A much smaller plant than the two following species, and agreeing with specimens collected in Capt. Franklin's voyage, in Herb. Torr. and Acad. of N. Sc.

Fiske Fiord, 64°, and as far north as Rensselaer Harbor, 79°.

18. *C. OFFICINALIS*, Linn. spec. pl. p. 903. Hook. Fl. Bor. Am. 1, p. 57. Silicles somewhat globose; root fleshy, fusiform.

Disko Island, 70°.

19. *C. ANGLICA*, Linn. spec. pl. p. 903. D. C. Prodr. 1, p. 354. Torr. and Gr. 1, p. 109. Silicles elliptical in a long raceme. Axis of the septum, in general, conspicuously fenestrate. Radical leaves wanting; those of the stem sessile, oblong-spathulate, with a few teeth. Root fibrous.

North Proven, 72°.

#### CARYOPHYLLACEÆ.

20. *ARENARIA GRŒNLANDICA*, Spreng. *Stellaria Grœnlandica*, Retz. Fl. Scand. D. C. Prodr. 1, p. 398. Fl. Dan. T. 1210. Torr. and Gr. 1, p. 180.

Sukkertoppen, 65°, Upernavik, 73°.

21. *A. ARCTICA*, var. *grandiflora*, Hook. Fl. Bor. Am. 1, p. 100, tab. 34, B. A beautiful pigmy species, not above one inch high, with, comparatively, very large flowers.

Upernavik, 73°.

22. *STELLARIA HUMIFUSA*, Rottb. Fl. Dan. T. 978. Hook. in Parry's 2d voy. app., p. 390, and Fl. Bor. Am. 1, p. 97. Torr. and Gr. 1, p. 184.

North Proven, 72°.

23. *A. LONGIPES*,  $\beta$ . *minor*, Hook. Fl. Bor. Am. 1, p. 95. Torr. and Gr. 1, p. 185. *S. stricta*, Rich., app. Frankl. Jour. ed. 2d, p. 15.

Sukkertoppen, 65°, Disko, 70°.

$\alpha$ . Torr. and Gr. 1, p. 185. *S. læta*, Rich., app. Frankl. Jour. ed. 2d, p. 16. Hook. app. Parry's 2d voy., and Fl. Bor. Am. 1, p. 96.

Bedivelled Reach, 78°.

$\epsilon$ . Torr. and Gr. 1, p. 185. *S. Edwardsii*, R. Br. app. Parry's 1st voy., p. 271. Hook. Fl. Bor. Am. 1, p. 96. *S. nitida*, Hook., app. Scoresby's voy., p. 411. *S. ovalifolia*, Hook.

Rensselaer Harbor, 79°, August 27.

24. CERASTIUM ALPINUM,  $\alpha$ . *C. alpinum*, Linn. Fl. Dan. T. 79. R. Br. in Ross' Voy. Hook. app. Parry's 2d Voy., p. 390. Torr. and Gr. 1, p. 188.

Fiske Fiord, 65°; North Proven, 72°, Upernavik, 73°.

$\beta$ . *C. Fischerianum*, Torr. and Gr. 1, p. 188. *C. Fischerianum*, Serr in D. C. Prodr. 1, p. 419. Cham. and Schl. in Linnæa, 1, p. 60. Hirsute with stiff hairs and sub-viscose. Stems rigid, ascendent, elongated; flowers dichotomous or subumbellate.

Sukkertoppen, 65°.

$\delta$ . *C. uniflorum*. Perhaps a new species? The only specimen in the collection has a thread-like root about ten inches long, bearing marks of absent fibres, but, in the present state, perfectly naked. From the neck of this root project whitish, filiform, subterranean stems, simple or dichotomous, with short internodes, each provided with a pair of small scarious leaves; the external stems are furnished with a rosula of ovate and softly lanuginous leaves, and each stem has a solitary erect peduncle, with 2-3 pairs of remote and appressed hoary leaves, and a single erect flower, nodding in the fruiting stage. Stems very numerous.

North Proven, 72°.

Another form of *C. alpinum*, which may be the same as the preceding, is rather smaller, with fewer stems and shorter scapes. The flowers are very large, with sepals terminating in a very acute membranaceous point, and the petals deeply obcordate.

Sukkertoppen, 65, and all the stations of Smith's Sound, from 78—80°.

25. SILENE ACAULIS, Linn. Pursh's Fl. p. 316. Hook. Fl. Bor. Am. 1, p. 87. Torr. and Gr. 1, p. 189.

Fiske Fork, 64°; Disko, 70°; N. Proven, 72° and 73°.

26. LYCHNIS APETALA,  $\alpha$ . Linn. Spec. pl. p. 626, Fl. Dan. T, 806. Hook. Fl. Bor. Am. 1, p. 91. *L. uniflora*, Ledeb. Torr. and Gr. 1, p. 194.

At almost every Station of both voyages, from 64° to 80°.

$\beta$ . *L. pauciflora*, D. C. Prodr. 1, p. 386. Torr. and Gr. 194. *L. pauciflora*, Fisch. Bedivelled Reach and other Stations of Smith's Sound.

27. L. ALPINA, Linn., Fl. Dan. T, 65. Pursh's Fl. p. 321. Torr. and Gr. 1, 194. Fiske Fiord, 64°; Sukkertoppen, 65°; Holsteinberg, 68°.

#### ROSACEÆ.

28. DRYAS OCTOPETALA, Linn. Pursh's Fl. p. 350. D. C. Prodr. 2, p. 550. Hook. Fl. Bor. Am. 1, p. 174. Torr. and Gr. 1, p. 420.

Bedivelled Reach and Rensselaer Harbor, 78 and 79°.



29. *D. INTEGRIFOLIA*, Vahl. Fl. Dan. T. 1216. Hook. Fl. Bor Am. 1, p. 174. Torr. and Gr. 1, p. 420.

Fiske Fiord, Holsteinborg, N. Proven, as far as the highest Stations of Smith's Sound.

30. *ALCHEMILLA VULGARIS*, Linn. Fl. Dan. T. 693. Engl. Bot. T. 597. D. C. Prodr. 2, p. 589. Torr. and Gr. 1, p. 432. A plant indigenous to the north of Europe, but very seldom found in North America.

Upernavik, 73°.

31. *A. ALPINA*, Linn. Pursh's Fl. p. 321. Fl. Dan. T. 49. Torr. and Gr. 1, p. 194.

Fiske Fiord, Sukkertoppen, 64 and 65°.

32. *POTENTILLA PULCHELLA*, R. Br., Ross' Voy. and Parry's 1st Voy. Suppl. p. 277. Hook. Parry's 2d Voy. and Fl. Bor. Am. 1, p. 191. *P. sericea*, Grev. Torr. and Gr. 1, p. 439. Stems 1—2-flowered. Leaves silky tomentose on both surfaces in several of my specimens, pinnæ very acute; peduncles 2—3 inches long with 1—2 small leaves. Flower rather large, of a deep yellow color; petals obcordate, longer than the calyx.

Upernavik, 73; and Rensselaer Harbor, 79°.

33. *P. NIVEA*, *a. discolor*, Fl. Dan. T. 1035. Pursh's Fl. p. 353. R. Br. in Parry's 1st Voy. app. p. 277. D. C. Prodr. 2, p. 572. Torr. and Gr. 1, p. 441.

Disko Island, 70°.

*β. oncolor*, Hook., Parry's 2d Voy. app. p. 395. *P. frigida*, Grev. *P. Grænlantica*, R. Br. in Ross' Voy. ed. 2d, p. 193. *P. verna*, Hook., Scoresby's Greenl. p. 431. Torr. and Gr. 1, p. 441. Leaves of the same color on both surfaces, sparsely villous; segments of the calyx very obtuse and shorter than the obcordate petals. Two flowerless specimens with a woody perpendicular root of the size of a small quill and very long, dividing at top into several stems, is undoubtedly the state of this variety, which is described by Dr. Hooker in his note to *Potentilla nivea*, at p. 195 of Fl. Bor. Am. vol. 1. The leaves are quinate, of a reddish hue with obovate leaflets.

Fiske Fiord, Upernavik, Rensselaer Harbor.

*γ.* Torr. and Gr. 1, p. 441. *P. hirsuta*, Vahl., Fl. Dan. T. 1390. *P. Vahlia*na, Lehm. *P. Jamesoniana*, Grev. A low species, resembling *P. nana*, with very hirsute leaves and brown toment underneath. Peduncles short, uniflorous; petals broadly obcordate, longer than the calyx.

Rensselaer Harbor, 79°.

34. *P. NANA*? Lehm. Potent. p. 181, T. 17. D. C. Prodr. 2, p. 573. Torr. and Gr. 1, p. 441.

Fog Inlet, 78°.

35. *P. AUREA*,  $\beta$ . D. C. Prodr. 2, p. 576. *P. salisburgensis*, Hænke, Torr. and Gr. 1, p. 441. A single specimen with leafy and sparingly hirsute 2—3-flowered stems. Radical leaves 3—5-foliolate, leaflets obovate, nearly glabrous, flowers on long filiform pedicels. Petals obcordate, deep yellow, nearly twice the size of the calyx. Resembling exactly the fig. of *P. aurea spontanea* of Haller's Synops. Potent. T. 8.

Fiske Fiord, 64°.

36. *P. TRIDENTATA*, Ait. Mich. Fl. Bor. Am. 1, p. 304. Hook. Fl. Bor. Am. 1, p. 195. Torr. and Gr. 1, p. 445.

Sukkertoppen, 65°; Holsteinborg, 68°; Rensselaer Harbor, 79°.

#### ONAGRACEÆ.

37. *EPILOBIUM ANGUSTIFOLIUM*, Linn. Hook. Fl. Bor. Am. 1, p. 205. *E. spicatum*, Lam. Dict. Bot. Torr. and Gr. 1, p. 487.

Fiske Fiord, Disko, Upernavik, 72°.

38. *E. LATIFOLIUM*, Linn. Fl. Dan. T. 365. Pursh's Fl. p. 259. Torr. and Gr. 1, p. 487.

Fiske Fiord, 64°; Upernavik, 73°.

#### CRASSULACEÆ.

39. *SEDUM RHODIOLA*, D. C. Prodr. 3, p. 401. *Rhodiola rosea*, Linn. *R. odorata*, Lam. Illustr. T. 1035. Torr. and Gr. 1, p. 558.

Holsteinborg, 68°; Upernavik, 73°.

#### SAXIFRAGACEÆ.

40. *SAXIFRAGA OPPOSITIFOLIA*, Linn. Fl. Lapp. T. 2. Pursh's Fl. p. 311. Hook. Fl. Bor. Am. 1, p. 243. Torr. and Gr. 1, p. 563.

At almost every station of the 1st and 2d Voyages.

This species varies very much in its forms: I have stems scarcely one inch high, densely cespitose, with leaves all imbricated in four rows and flowers almost sessile; others with numerous branches thickly set and spreading on the ground, leaves imbricated in the inferior part and opposite towards the top; others again with long sterile branches and leaves all opposite and remote. I have also the form *S. Eschscholtzii* of Sternb., with silvery gray foliage, which cannot be separated from this species. From the large and beautiful purple flowers, apparently monopetalous, which are peculiar to this species, I have no doubt it is the plant mistaken for a gentian by Dr. Kane, in the narrative of his first expedition.

From N. Proven, 72°, to the most northern stations of Smith's Sound.

41. *S. FLAGELLARIS*, Willd. ex. Sternb. Rev. Saxifr. p. 25, T. 6. R. Br. Parry's 1st Voy. suppl. p. 273. *S. setigera*, Pursh's Fl. p. 312. Torr. and Gr. 1, p. 564. Disko, 70°; Fog Inlet, 78°; Rensselaer Harbor, 79°; Aug. 27th.

42. *S. AIZOIDES*, Wahl. Fl. Lapp. p. 115. Pursh's Fl. p. 312. Hook. Fl. Bor. Am. 1, p. 255. Torr. and Gr. 1, p. 565. *S. autumnalis*, Linn. Upernavik, 73°.

43. *S. TRICUSPIDATA*, Retz. Prodr. Scand. Pursh's Fl. 1, 312. Hook. Fl. Bor. Am. 1, p. 254. Fl. Danica, T. 976. Torr. and Gr. 1, p. 565. Holsteinborg, 68°; Fog Inlet, 78°; Rensselaer Harbor, 79°.

44. *S. CÆSPITOSA*,  $\alpha$ . Hook. *S. cœspitosa*, Linn. Don. Saxifr. Pursh's Fl. 1, p. 312. Wahl. Fl. Lapp. p. 119. *S. Grœnlandica*, Linn. D. C. Prodr. 4, p. 27. Torr. and Gray 1, p. 565. Of this variety I have three different forms; one with cauline leaves all entire; the second with all the cauline leaves 3-cleft and cuneate; the third with both forms of leaves on the same stem.

Fiske Fiord, 64°; Disko, 70°; Proven, 72°, &c.

$\beta$ . Hook. *S. uniflora*, R. Br. in Parry's 1st Voy., suppl. p. 274. *S. cœspitosa*, Engl. Bot. T. 764. *S. venosa*, Haw. Enum. Saxifr. p. 28. Torr. and Gr. 1, p. 565. Upernavik to Rensselaer Harbor, 73—79°.

45. *S. AIZOON*, Jacq. Fl. Aust. 5, T. 438. Pursh's Fl. p. 310. Hook. Fl. Bor. Am. 1, p. 243. *Chondroza aizoon*, Haw. Enum. Saxifr. Torr. and Gr. 1, 566. Fiske Fiord, Upernavik, 64—73°.

46. *S. NIVALIS*,  $\alpha$ . *S. nivalis*, Linn. Pursh's Fl. p. 310. R. Br. Parry's 1st Voy. suppl. p. 275. D. C. Prodr. 4, p. 38. Torr. and Gr. 1, p. 571. Fog Inlet, Bediveled Reach, Rensselaer Harbor, 78—79°.

$\beta$ . Hook. Fl. Bor. Am. 1, p. 248. Torr. and Gr. 1, p. 571. Heads loose and branched. It does not seem to differ from *S. reflexa*, Hook. Fl. Bor. Am. T. 85, otherwise than by the petals of the latter being bimaculate. In my specimens, which are rather advanced, the filaments of the stamina are purple.

Upernavik, 73°.

47. *S. FOLIOLOSA*, R. Br. in Parry's 1st Voy. suppl., p. 275. Hook. in Parry's 2d Voy. suppl., p. 13, and Fl. Bor. Am. 1, p. 251. *S. stellaris*,  $\gamma$ . Linn. Fl. Lapp. *S. stellaris*,  $\beta$  *comosa*, Willd. Torr. and Gr. 1, p. 570. Specimens not yet in bloom. Scapes 3—3½ inches high, naked at base and dividing at top into small branches, each crowned with a fascicle of small oval and concave leaves, in the centre of which

a small oval flowering bud is just perceptible. Radical leaves cuneiform, with two minute lateral teeth on each side and terminating in an acute apex.

Fog Inlet, 78°.

48. *S. CERNUA*, Linn. Fl. Lapp. T. 2. R. Br. in Perry's 1st Voy. suppl., p. 275. Hook. Fl. Bor. Am. 1, p. 245. Torr. and Gr. Fl. 1, p. 575. Very remarkable by the upper leaves bearing in their axils little bulbs of abortive flowers.

Disko, 70°, and all the stations of Smith's Sound to 80° N. lat.

49. *S. RIVULARIS*, Linn. Fl. Lapp. T. 2. Pursh's Fl., p. 312. D. C. Prodr. 4, p. 36. Hook. Fl. Bor. Am. 1, p. 246. Torr. and Gr. 1, p. 574.

Fiske Fiord, 64°.

### COMPOSITÆ.

50. *GNAPHALIUM SYLVATICUM*, Linn. Engl. Bot. T. 913. Pursh's Fl., p. 525. Hook. Fl. Bor. Am. 1, p. 319.

Upernavik, 73°.

51. *HIERACIUM VULGATUM*? Fries. *H. molle*! Pursh's Fl., p. 525. Hook. Fl. Bor. Am. 1, p. 299. Torr. and Gr. 2, p. 475. Stem 18—20 inches high, erect, naked above, with a corymb of 3—4 large flowers. Radical leaves petiolate, attenuate at both ends, with a few remote, obscure, and mucronate teeth from the base to the middle, entire upwards. A few sessile cauline leaves to about the middle of the stem.

Fiske Fiord, 64°; and Upernavik, 73°.

52. *ARNICA ANGUSTIFOLIA*, Vahl. Fl. Dan. T. 1524. D. C. Prodr. 6, p. 317. *Arnica montana*, var. *alpina*, Linn. *A. alpina*, Wahl. *A. plantaginea* and *A. fulgens*, Pursh's Fl., p. 527. Torr. and Gr. 2, p. 449.

Near Smith's Sound, 78°.

53. *TARAXACUM PALUSTRE*, D. C. Fl. Fr. and Prodr. *Leontodon palustre*, Smith, Br. Fl. 2, p. 823. Hook. Fl. Bor. Am. 1, p. 296. *Leontodon taraxacum*,  $\beta$ . *salinum*, E. Mey. pl. Labr. p. 58. *Taraxacum montanum*, Nutt. in Torr. and Gr. 2, p. 494.

Wolsteinholm and below Bediveled Reach, 76—78°.

### CAMPANULACEÆ.

54. *CAMPANULA LINIFOLIA*, A. D. C. Camp., p. 179. *C. rotundifolia*,  $\beta$ . *linifolia*, Rich. in Frankl. 1st jour., ed. 2d, app., p. 61. The only specimen I have is stript of its radical leaves; the inferior cauline are petiolate, oval-lanceolate, the upper ones linear-lanceolate, entire or with a few teeth. Flowers only two, (there might have been three) rather large, on filiform pedicels with two linear bracts at the

base; teeth of the calyx very short and subulate; lobes of the corolla round-oval; stamina one-third the length of the style. Stigmata 5?

Holsteinborg, 68°.

55. *C. UNIFLORA*, Linn. Fl. Lapp. T. 9. Fl. Dan. T. 1512. Hook. Fl. Bor. Am. 2, p. 29. A form between the Linnean plant and  $\beta$ . *Gieseckiana*, of D. C. Pr. 7, p. 482. Calyx invertedly conical with divisions half the length of those of the corolla, but much shorter than in var.  $\beta$ . Otherwise corresponding with the Linnean description.

Upernavik, 73°.

#### ERICACEÆ.

56. *VACCINIUM ULIGINOSUM*, Linn. Mich. Fl. Bor. Am. 2, p. 235. Pursh's Fl., p. 288. Rich. Frankl. 1st jour. ed. 2d, app., p. 22. Asa Gray Man., ed. 1st, p. 261.

Fiske Fiord, Disko, Proven, Upernavik, Smith's Sound, 78°.

57. *CASSIOPE TETRAGONA*, Don. in D. C. Prodr. 7, p. 611. *Andromeda tetragona*, Linn. Fl. Dan. T. 1030. Pursh's Fl., p. 290. Hook. Bot. Mag. T. 3181, and Fl. Bor. Am. 2, p. 58. There are specimens among them very branching and more than a foot long.

Disko, Proven, Fog Inlet, Bediveled Reach, fr. 70 to 79°.

58. *PHYLLODOCE TAXIFOLIA*, Salisb. A. Gray. Man. ed. 1, p. 267. *Menziesia coerulea*, Sw. Eng. Bot. T. 2469. *Andromeda coerulea*, Linn. Fl. Dan. T. 57. *A. taxifolia*, Pull.

Fiske Fiord, 64°; Disko, 70°.

59. *RHODODENDRON LAPPONICUM*, Wahl. Fl. Lapp., p. 104. Hook. Bot. Mag. T. 3106, Fl. Bor. Am. *Azalea Lapponica*, Linn. Fl. Lapp., p. 89, T. 6. Pallas' Fl. Ross 2, p. 52. Asa Gray. Man. ed. 1, p. 269.

Holsteinborg, 68°.

60. *LOISELEURIA PROCUMBENS*, Desv. Asa Gray. Man. ed. 1, p. 270. *Azalea procumbens*, Linn. Pursh's Fl., p. 154. Hook. Fl. Bor. Am. 2, p. 44.

Egedesminde, 69°.

61. *LEDUM PALUSTRE*, Linn. Pursh's Fl., p. 301. Hook. Fl. Bor. Am. 1, p. 44. Sukkertoppen, 65°; Holsteinberg, 68°.

62. *PYROLA CHLORANTHA*, Swartz. Hook. Fl. Bor. Am. 2, p. 46. A. Gray. Man. ed. 1, p. 279. Rich. in Frankl. 1st jour. ed. 2, p. 13. Nutt. Gen. Am. 1, p. 273.

Disko, 70°; N. Proven, 72°; Smith's Sound Stations, 78°.

## BORAGINEÆ.

63. *MERTENSIA MARITIMA*, Don. Gen. Syst. 4, p. 320. D. C. Prodr. 10, p. 88. *Pulmonaria maritima*, Linn. Fl. Dan. T. 25. *Lithospermum maritimum*, Lehm. Hook. Fl. Bor. Am. 2, p. 86. *Pulmonaria parviflora*, Mich. Disko, 70°; N. Proven, 72°.

## SCROPHULARIACEÆ.

64. *BARTSIA ALPINA*, Linn. Engl. Bot. T. 361. Fl. Dan. T. 43. D. C. Prodr. 10, p. 544. Fiske Fiord, 64°.

65. *PEDICULARIS ARCTICA*, R. Br. in Parry's 1st Voy. app., p. 270. *P. Langsdorffii*, Fisch. MS. in Hook. Fl. Bor. Am. 2, p. 109. *P. purpurascens*, Spreng. *P. hirsuta*, Rich. app. Frankl. Voy., p. 25. D. C. Prodr. 10, p. 568. Stems short and few; cauline leaves with tomentose and conspicuously dilated rachis. Bracts pinnate; flowers dark purple, with two small teeth at the helmet. Corolla and calyx of a tougher texture than in the following species, the former 3—4 times longer than the latter. Stigma emarginate; germ ovate.

Rensselaër Harbor, 79°.

66. *P. KANEI*, Nov. Spec. Caulibus compluribus; foliis linearibus glabris; pinulis minutis, omnibus remotis, rachi petioloque vix dilatatis; corollâ roseâ, galeâ edentatâ.

Planta quâm præcedens robustior, radice carnosâ palmatim ramosâ. Caules complures, vix lanati; folia linearia, glabra, pinnatifida; pinnulæ minutæ, omnes remotæ, margine sursum fere integrâ, deorsum acute serratâ; petiolus foliorumque rachis vix dilatati; prior ad basin parce lunatus. Spica densa; bracteæ lanuginosæ angustolanceolatæ, fere integræ, ad apicem tantummodo obscure pauci-dentatæ. Calyx 5—6 fidus, lanâ albâ densissimâ implexus; corolla rosea, texturâ tenerrimâ, calyce duplo longior; labium inferius tripartitum, suberoso-dentatum; lobus medianus subrotundus (in præcedenti emarginatus) galea minus incurva, angustior, edentata. Staminorum filamenta pilosa; stigma subrotundum, papillosum, integrum; germen subglobosum.

*Pedicularis Kanei* is easily distinguished from *P. arctica* by the delicacy of its pinules, which are all remote on a rachis scarcely dilated; by its bracts, perhaps more lanuginous, but almost entire; by its rose colored flowers, its edentate helmet, and the thin texture of its corolla and calyx. The middle lobe of the inferior lip and stigma are not emarginate as in *P. arctica*, and the germ is of a more globose form. It is, moreover, a larger plant, with many more stems and a more fleshy root.

67. *P. HIRSUTA*, Linn. D. C. Prodr. 10, p. 578. Hook. Fl. Bor. Am. 2, p. 109.

*P. lanata*, Willd. A larger plant than the two preceding, with erect, leafy and lanuginous stems. Leaves linear-lanceolate, pinnatifid with the rachis remarkably dilated; the lower pinnules very small, the other larger and dentate. Spike leafy and crowded; calyx half the length of the corolla, which is much smaller than in the two preceding species, and of a yellow color. An old stem in fruit, seven inches high and quite glabrous, with mucronate pods at least half an inch long, has the leaves bipinnate. Other imperfect specimens from N. Proven are not half the size of those from Smith's Sound, with very small flowers, seem to belong to the same species—perhaps a variety?

Proven, 72°; Fog Inlet, 78°; Rensselaer Harbor, 79°.

#### LABIATÆ.

68. *THYMUS SERPYLLUM*, var. *arcticum*. Nov. var. Foliis pellucido-punctatis, ad basin ciliatis, 5-venosis, venis subtus valde prominentibus. Calycis dentibus corollæque lobis ciliatis.

This variety is probably the same as that collected by Vahl on the eastern coast of Greenland, and described by Prof. Horneimann as var. *decumbens*. The stems are quite prostrate, as almost all the forms of *serpyllum*; the leaves are of a pale green color, with pellucid dots, ciliate at base, and with veins remarkably prominent and symmetrical. Flowers capitate among the upper leaves, which, as well as the calyces, are tinged with bright purple. Calycinal teeth and lobes of the corolla ciliate.

Fiske Fiord, 65°.

#### DIAPENSIACEÆ.

69. *DIAPENSIA LAPPONICA*, Linn. Asa Gray. Man. ed. 1, p. 346. I do not think this plant was ever found before in such high latitudes.

Collected by Dr. Kane on his return home in latitude 73°.

#### POLYGONACEÆ.

70. *POLYGONUM VIVIPARUM*, Linn. Pursh's Fl., 271. Engl. Bot. T. 669. Rich. app., p. 43. Asa Gray. Man. ed. 1, p. 386.

Found at every station of both voyages.

71. *OXYRIA DIGYNA*, Campd. A. Gray. Man. ed. 1, p. 391. *O. reniformis*, Hook. *Rumex digynus*, Pursh's Fl., p. 248. Engl. Bot. T. 910.

With the preceding at almost all the stations from 64° to 80°.

#### EMPETRACEÆ.

72. *EMPETRUM NIGRUM*, Linn. Pursh's Fl., p. 93. Engl. Bot. T. 315. A. Gray.



Man. ed. 1st, p. 409. It is, in those regions, the ordinary food of deer and rabbits. Dr. Kane.

Fiske Fiord, 64°; Disko, 70°; and on Smith's Sound.

## BETULACEÆ.

73. *BETULA NANA*, Linn. Engl. Bot. T. 349. Pursh's Fl., p. 622. Fl. Dan. T. 91.

Holsteinborg, 68°.

## SALICACEÆ.

74. *SALIX DESERTORUM*, Rich. app., p. 37. Hook. Fl. Bor. Am. 2, p. 151.

Fiske Fiord, 64°.

75. *S. UVA-URSI*, Pursh's Fl., p. 610. Hook. Fl. Bor. Am. 2, p. 152. A. Gray. Man. ed. 1st, p. 429. *S. glauca*, Horn. app. Cap. Graah's Voy. and Dr. Kane. Stem erect, one foot high, or prostrate. Bark of branches greenish. Leaves elliptical or obovate, slightly toothed, glabrous and shining above, glaucous beneath. The specimens are all in a fruiting state and larger than those of the White Mountains. Catkins long, cylindrical, rather loose; pods glabrous, shortly pedicellate, tapering into a beak, of an orange color or turning black.

Fiske Fiord and Sukkertoppen, 64 and 65°.

76. *S. ARCTICA*, R. Br. Ross' Voy. ed 2d, vol. 2, p. 194, and in Melville Island Plants, p. 272, (not Pallas). Hook. Fl. Bor. Am. 2, p. 152. *S. lanata*! Dr. K. Prostrate with tortuous branches furnished with a light brown or yellow bark. Leaves entire and very variable, (lanceolate-acute, elliptic, oval or obovate, cuneate or spatulate,) strongly veined, subsericeous with long hairs, when young or even in the fruiting stage, generally very apt to turn black on drying. Fertile catkins long pedunculate, cylindrical or ovoid-oblong; scales villous, broad-oval, of a brown or dusky color. Style elongated. Ovary thickly tomentose.

Sukkertoppen, 65°; Holsteinborg, 68°; as far as 76° N. latitude.

I have been somewhat perplexed with specimens collected by Dr. Kane at the Smith's Sound Stations. They are comparatively smaller in all their parts, and have dried yellow, probably from some atmospheric causes, or the more advanced season. Some of these specimens, with leaves quite lanceolate and acute at both ends, and small ovoid catkins, resemble the figure of *S. Lapponum*, in Fl. Dan. T. 1050, except that their leaves are petiolate. They are, however, subject to all the same variations in leaves and catkins as *S. arctica* of the lower latitudes, and Dr. Torrey says they agree well with the Hookerian specimens of his herbarium.

77. S. HERBACEA, Linn. Hook. Fl. Bor. Am. 2, p. 153. A. Gray. Man. ed. 1st, p. 43.

Holsteinborg, 68°; Upernavik, 73°.

## MONOCOTYLEDONOUS PLANTS.

### ORCHIDACEÆ.

78. PLATANThERA HYPERBOREA, Lindl. Gen. Orch. p. 287. Hook. Fl. Bor. Am. 2, p. 198. *Habenaria hyperborea*, R. Br. and Rich. app. 2, p. 33. *Orchis hyperborea*, Pursh's Fl., p. 588.

Fiske Fiord, 65°.

### MELIANTHACEÆ.

79. TOFIELDIA PALUSTRIS, Huds. *T. borealis*, Wahl. *T. pusilla*, Pers. Pursh's Fl., p. 246. *Narthecium pusillum*, Mich. Fl. Bor. Am. 1, p. 219. Hook. Fl. Bor. Am. 2, p. 179.

Fiske Fiord, 64°.

### JUNCACEÆ.

80. LUZULA SPICATA, Desv. A. Gray. Man. ed. 1st, p. 505. *Juncus spicatus*, Linn. Engl. Bot. T. 1174.

Fiske Fiord and Sukkertoppen.

81. L. HYPERBOREA, R. Br. Melville Island Plants, p. 183. Hook. in Parry's 2d Voy. app. p. 405. *L. campestris*, R. Br. Spitzb. app., p. 75. *Juncus arcuatus*, Hook. Fl. Bor. Am. 2, p. 189.

Below Bediveled Reach, 79°.

82. L. ARCUATA, Meyer. Asa Gray. Man. ed. 1st, p. 505. Hook. Fl. Bor. Am. 2, p. 189.

Fog Inlet, 78°.

These two last species, which are of small stature and with black spikes, are easily distinguished from each other. *L. hyperborea* has the leaves flat, whilst *L. arcuata* has them channeled and linear.

83. JUNCUS TRIFIDUS, Fl. Dan. T. 107. Lam. Dict. Bot. Asa Gray's Man. ed. 1st, p. 508.

Fiske Fiord, 64°.

84. J. ARCTICUS, Linn. Fl. Lapp., p. 116. D. C. Fl. Fr. 3, p. 165. Scapes simple, rigid, naked, 8—10 inches high, furnished at base with long striated sheaths, springing

up from matted horizontal rootstocks. Panicle few-flowered, apparently lateral from the spathe, terminating in a long and acute point. Sepals dark brown.

Sukkertoppen, 65°; intermixed with *Luzula spicata*.

## CYPERACEÆ.

85. CAREX RIGIDA, Good. *C. saxatilis*, Linn. Fl. Dan. &c.

Frequent at almost every station.

86. . . . . aff. *C. dioicæ*. A single specimen with solitary staminate spikes of an ovoid form. Leaves all radical and flat. Culm apparently flat (perhaps 3-angular), 3 inches high and rather shorter than the leaves; scales obtuse, of a light brown color, stamina much exerted and whitish.

Fiske Fiord, 64°.

87. . . . . aff. *C. retroflexæ*. Too young to determine.

Fiske Fiord.

88. SCIRPUS CÆSPITOSUS, Linn. D. C. Fl. Fr. 3, p. 135. Asa Gray's Man. ed. 1st, and Gram. and Cyper. Very small form, not three inches high.

Fiske Fiord and Sukkertoppen.

89. ERIOPHORUM CAPITATUM, Host. *E. scheuchzeri*, Hoppe. *E. vaginatum*,  $\beta$ . Sutt. Helv., p. 28. Lam. Dict. suppl. 3, p. 445. D. C. Fl. Fr. 3, p. 132. Culm cylindrical, 6—8 inches high, with smaller heads than the following, but hardly distinguished from it by other characters than being provided with a brown oval and persistent spathe instead of scales. Sheaths terminating in a short acumination, but sometimes quite leafy. Leaves channeled at base, flat above and terminating in a triangular blunt point, longer than the culm and more or less scabrous on the margin.

Fiske Fiord, 64°, and Rensselaer Harbor, 80°.

90. E. VAGINATUM, Linn. Engl. Bot. T. 873. D. C. Fl. Fr. 3, p. 132. Asa Gray. Man. ed. 1st, and Gram. and Cyper. No. 88. Hook. Fl. Bor. Am. 2, 231. Culm 7—8 inches high, with two sheaths at the base, terminating in a short acumination. Leaves all radical, triangularly channeled, half the length of the culm. Spathe none; scales numerous, ovate and acuminate, of a lead color; mature silky heads more than one inch in diameter, almost globular.

Sukkertoppen, 65°.

91. E. POLYSTACHYON, Linn. Spec. pl. p. 76. *E. latifolium*, Hoppe. Specimens from 4—15 inches high, not in fruit.

Stations of Smith's Sound to Rensselaer Harbor, 80°.

## GRAMINEÆ.

92. *Alopecurus alpinus*, Engl. Bot. T. 1126. R. Br. in Parry's 1st Voy., p. 184. Rich. app. ed. 2, p. 3. Hook. in Parry's 2d Voy. app., p. 184. Egedesminde, Bediveled Reach, 79°; Aug. 11.

93. *Phippisia algida*, R. Br. in Ross' Voy. ed. 2, p. 191, and in Parry's 1st Voy. app., p. 195. *Agrostis algida*, Soland. in Phipps' Voy. p. 200. *Trichodium algidum*, Swensk. Bot., p. 545. North Proven, 72°.

94. *Agrostis canina*,  $\beta$ . *Melaleuca*, Bong. Veget. de Sitka, p. 20. Hooker Fl. Bor. Am. 2, p. 240.

Two forms, one larger, 10—12 inches high, from Sukkertoppen; the other nearly half the size from Smith's Sound.

95. *Calamagrostis canadensis*, P. Beauv. *Arundo canina*, Mich. *Calamagrostis mexicana*, Nutt. Sukkertoppen, 65°.

96. *C. stricta*, Nutt. Torr. Rich. app. ed. 1st, p. 3. *Arundo neglecta*, Ehrh. Sukkertoppen, 65°.

97. *Glyceria arctica*, Hook. Fl. Bor. Am. 2, p. 248. Dr. Torrey. Holsteinborg, 68°.

98. *Catabrosa aquatica*, P. Beauv. Agrost. p. 97, T. 19, Fig. 8. Dr. Torrey. *Aira aquatica*, Linn. Sukkertoppen, 65°.

99. *Poa arctica*, and var. R. Br. in Parry's 1st Voy. app. Hook. in Perry's 2d, 3d and 4th Voy., and in Bot. of Beech. Voy., p. 133. *P. laxa*, R. Br. Three different forms, a large one 15 inches, some middle forms 6—7 inches high, and a remarkably small one, with almost filiform leaves, which might prove a different species. The largest from Sukkertoppen, the others from Smith's Sound.

100. *P. alpina*, Linn. Hook. Fl. Bor. Am. 2, p. 244. Dr. Torrey. Several forms. Fiske Fiord, 65°; N. Proven, 72°; Rensselaer Harbor, 80°.

101. *Festuca ovina*, Linn. Gray's Man. ed. 1st, p. 599. Dr. Torrey. Two forms. Sukkertoppen, 65°; Rensselaer Harbor, 80°. The latter not above 6 inches high.

102. *F. richardsoni*? Hook. Fl. Bor. Am. 2, p. 250. Variety with smooth flowers. Dr. Torrey. Fiske Fiord, 64°.

103. *BROMUS KALMII*? Dr. Torrey. A. Gray's Man. ed. 1st, p. 600. *B. ciliata*, Muhl. *B. purgans*, Torr. Fl. N. S.

Sukkertoppen, 65°.

104. *ELYMUS ARENARIUS*, Linn. Engl. Bot. T. 1672. Hook. and Arn. Bot. of Beech. Voy., p. 119 and 132. Hook. Fl. Bor. Am. 2, p. 255.

Holsteinborg, 68°.

105. *AIRA FLEXUOSA*, Linn. A. Gray's Man. ed. 1st, p. 605.

Sukkertoppen, 65°.

106. *TRisetum SUBSPICATUM*, Linn. Hook. and Arn. Bot. of Beech. Voy., p. 119 and 132.

Fiske Fiord, 64°; and Bediveled Reach, 79°.

## CRYPTOGAMOUS PLANTS.

### EQUISETÆ.

107. *EQUISETUM ARVENSE*, Linn. Barren fronds only.

Fiske Fiord, 64°; North Proven, 72°.

### FILICES.

108. *POLYPODIUM PHEGOPTERIS*? Linn. Too young and without fruit dots.

Sukkertoppen, 65°.

109. *WOODSIA ILVENSIS*, R. Br. A. Gray's Man. ed. 1st, p. 629. *Nephrodium rufidulum*, Mich.

Fiske Fiord, 64°; N. Proven, 72°.

110. *CYSTOPTERIS FRAGILIS*, Bernh. A. Gray's Man. ed. 1st, p. 629. Large fruiting specimens 8—10 inches long, with stalks.

Disko, 70°; Wolstenholm, 76°.

Another state (very young) of probably the same fern was collected at Rensselaer Harbor. It is scarcely more than 4 inches long, narrower and less divided, without fruit dots. Perhaps var. *dentata*, Hook. A. Gray's Man. p. 629.

### LYCOPODIACEÆ.

111. *LYCOPodium SELAGO*, Linn. A. Gray's Man. ed. 1st, p. 637.

112. *L. ANNOTINUM*, Linn. A. Gray's Man. ed. 1st, p. 637.

113. *L. ALPINUM*, Linn. Engl. Bot. T. 234.

All collected at Fiske Fiord, 64°.

## MUSCI.

114. SPHAGNUM SQUARROSUM, Pers.

Disko Island.

115. S. ACUTIFOLIUM, Ehrh.

Fiske Fiord.

116. S. RECURVUM, Brid.

Sukkertoppen.

117. TETRAPLODON MNIOIDES, Bruch and Schimper.

Disko Island.

118. SPLACHNUM VASCULOSUM, Linn.

Proven.

119. S. WORMSKIOLDII, Horn.

Bediveled Reach.

120. BRYUM LUCIDUM, James, Nova species.

Proven.

This species in all its characters resembles *Bryum crudum*, except the capsule, which is oval without a colla, and not pyriform, and of a dark brown color.

121. B. MUHLENBECKII, Bruch and Schimper.

Proven.

122. AULACOMNION TURGIDUM, Schwæg.

Proven.

123. POLYTRICHUM JUNIPERINUM, Hedw.

Disko Island, Proven.

124. DICRANUM SCOPARIUM,  $\beta$ . *orthophyllum*, Br. and Schimp.

Fiske Fiord.

125. D. ELONGATUM, Schwæg.

Proven.

126. D. VIRENS, Hedw.

Fiske Fiord.

*D. virens*,  $\beta$ . *Wahlenbergii*, Br. and Schimp.

Disko Island.

*D. virens*, variety.

Disko Island.

127. *D. RICHARDSONI*, Hook.

Fiske Fiord.

128. *D. MUHLENBECKII*, Br. and Schimp.

Fiske Fiord.

129. *D.* — aff. *FALCATUM*, Hedw.

Fiske Fiord.

130. *D.* — aff. *STARKII*, Weber and Mohr.

Fiske Fiord.

131. *RACOMITRIUM LANUGINOSUM*, Brid.

Fiske Fiord.

132. *WEISSIA CRISPULA*, Hedw

Proven.

133. *HYPNUM RIPARIUM*, Linn.

Bediveled Reach.

134. *H. UNCINATUM*, Hedw.

Sukkertoppen, Fiske Fiord, Proven.

135. *H. CORDIFOLIUM*, Hedw.

Fiske Fiord.

*H. cordifolium*, var. Br. and Schimp.

Fiske Fiord.

136. *H. STRAMINEUM*, Dickson.

Sukkertoppen and Fiske Fiord.

137. *H. SARMENTOSUM*, Vahl.

Fiske Fiord.

138. *H. SCHREBERI*, Willd.

Fiske Fiord.

#### HEPATICÆ.

139. *PTILIDIUM CILIARE*, Nees.

Fiske Fiord.

140. *SARCOCYPHUS EHRHARTI*, Cord.

Proven.

141. *JUNGERMANNIA DIVARICATA*, Engl. Bot.

Fiske Fiord.



142. *J. SQUARROSA*, Hook.  
Fiske Fiord.

## THALLOPHYTES.

143. *CETRARIA ISLANDICA*, Ack.  
Fiske Fiord.
144. *PELTIGERA CANINA*, Hoffm.  
Fiske Fiord.
145. *CLADONIA PYXIDATA*, Fries.  
Fiske Fiord.
146. *C. RANGIFERA*, Hoffm.  
Fiske Fiord.
147. *C. FURCATA*, Floerk.  
Fiske Fiord.
148. . . . . Another species in an imperfect state.  
Fiske Fiord.

NOTE.—A full set of the above plants has been incorporated in the Herbarium Boreali-Americanum of the Philadelphia Academy of Natural Sciences. E., D.

ART. XVII.—*A Commentary on the Synopsis Fungorum in Americâ Boreali mediâ degentium, by L. D. de Schweinitz.*

By the REV. M. J. BERKELEY, M. A., F.L.S., and the REV. M. A. CURTIS, F. A. A. S.

With a view to place the Mycology of the United States on a firm and stable foundation, a careful examination of most of the species which still exist in the Herbarium of Schweinitz has been instituted by the authors of the present Memoir. Free access has been also had to the numerous authentic specimens in the Herbarium of Sir Wm. Hooker, and Prof. Torrey has kindly presented us the collection given him by Schweinitz. About a fourth of the species have passed under review, and as the examination of the remainder must necessarily be a work of time, we think it best to publish the present by way of instalment. When the whole has been reviewed, we hope to be in a position to give a complete Mycology of the United States, for which we have immense materials. As Schweinitz did not possess types of the greater part of the European species, it was impossible that he should not have made many mistakes in the determination of species; but though we have been compelled to differ frequently from him in his diagnoses, the species which he has published as new, with few exceptions, still hold their place in science, and present numberless points of interest as regards structure and affinity. He was, however, very far from exhausting the treasures of the American forests. We have in our possession a host of new species, equal in interest to those which first gave so high a character to American Fungi; and a review of these authentic specimens has, in only a very few instances, compelled us to change our nomenclature. There will be no longer delay in the publication of the remainder of our commentary, than unavoidable circumstances may necessitate.

\*\*\* When our paper upon the Exotic Fungi of the Schweinitzian Herbarium (see Journ. Acad. ii. p. 277) was written, we had not ascertained from whom the Surinam species were procured, there being no recognition of the collector upon the tickets. We have since learned that the collection was made by Dr. Hering, now a distinguished Homœopathic Physician of Philadelphia. Dr. Schweinitz had evidently intended to commemorate this gentleman's services in Natural History by naming for him the genus since published by Berkeley under the name of *HYPOLYSSUS*. (See Exot. Fung. No. 15.) *HERINGIA* is now devoted by Agardh to a genus of Algæ.

100. *AGARICUS SICCUS*, Schwein.! This resembles very closely *Marasmius hæmatocephalus*, Mont., but the upper half of the stem has a transparent appearance, and there is a cottony tuft at the base. The appearance of the stem is very much like that of *A. cohærens*. Schweinitz' description of it does not accord very well with the specimens.

147. *A. PETALOIDES*, Bull. Certainly not the plant of Bulliard, though similar in habit. It is *Panus angustatus*, Berk. in Hook. Lond. Journ. vi. 318.

152. *A. STYPTICUS*, Bull.=*Panus stipticus*, Fr.

154. *A. ALGIDUS*, Fr.=*A. atrocoeruleus*, Fr.

159. "*A. APPLICATUS*, Batsch. *epigæus*." Probably a distinct species.

162. *A. NIGER*, Schwein.! A larger species than *A. applicatus*, very dark and with somewhat of the habit of *Xerotus*.

229. *A. DEPLUENS*, Batsch.

230. *A. VIOLACEO-FULVUS*, Schwein. Apparently *A. pinsitus*, Fr. Certainly not a *Crepidotus*.

267. *FAVOLUS ALVEOLARIUS*, Fr.=*Polyporus Boucheanus*, Fr.

268. *F. ABNORMIS*, Schwein., marked "*Favus membranaceus*" in the Herbarium, has the hymenium of *Glæoporus*, of which it may be a resupinate form.

269. *LENTINUS SCHWEINITZII*, Fr.

278. *CANTHARELLUS AURANTIACUS*, Fr. In the fragments we possess of what Schweinitz assigned to this species, the gills or folds are far broader than in any European specimens. We consider the name, therefore, as very doubtful. The species has not yet occurred in S. Carolina.

281. *C. LUTESCENS*, Fr.

282. *C. CINEREUS*, Fr.

284. *C. ODORATUS*, Schwein.!=*Craterellus odoratus*, Fr.

286. *C. CINNABARINUS*, Schwein.!=*Hygrophorus cinnabarinus*, Fr.

287. *C. FLOCCOSUS*, Schwein.! *C. Canadensis*, Kl. is apparently the same species.

289. *C. CRISPUS*, Fr. This seems to be a common species in the Northern States, but has not yet been detected in the Southern.

290. *C. INCARNATUS*, Schwein.! More properly a *Merulius*, and evidently allied to *M. tremellosus*. Authentic specimens exist in the Herbarium of Sir Wm. Hooker. Not an uncommon species in the Carolinas.

291. *C. CONFLUENS*, Schwein. != *Merulius corium*, Fr.
292. *C. SPATHULARIA*, Schwein. != *Guepinia spathularia*, Fr.
293. *C. CUPRESSI*, Schwein. ! This is no Fungus, but a curious gall on the leaves of *Taxodium*. It appears to be a common production in the United States.
298. *C. CUPULARIS*, Fr. Our specimens of this are imperfect.
299. *C. FASCICULATUS*, Schwein. ! This is properly a *Cyphella*. There is a species in our collections to which we gave the name of *Cyphella fasciculata* before we knew that the plant of Schweinitz belonged to that genus, exactly agreeing in habit, but of a paler and more washy tint, perhaps from being exposed to the weather.
300. *C. OLIVACEUS*, Schwein. ! There is but a single specimen of this in the Herbarium, and it is arranged there under *Merulius*. At the time of our examination we referred this to *Paxillus pannuoides*, Fr., but it may perhaps be *P. Curtisii*, Berk.
302. *SCHIZOPHYLLUM COMMUNE*, Fr. (Hook. Herb.)
315. "BOLETUS (NON FLOCCOPUS.)" = *B. strobilaceus*, Scop. (*Strobilomyces*, Berk.)
323. *POLYPORUS FULIGINOSUS*, Fr., more properly *fuliginus*.
326. *P. LEPTOCEPHALUS*, Fr. Nearly destroyed, but is *P. brumalis* or *arcularius*.
328. *P. RUFESCENS*, Fr., marked by Schweinitz *P. cinnamomeus*. It is certainly not *P. rufescens*, but a state of his own *P. connatus*, of which he considered *P. cinnamomeus*, P., a synonym.
329. *P. SCHWEINITZII*, Fr. *P. tabulæformis*, Berk., is confounded with this.
330. *P. CONNATUS*, Schwein. ! A fine authentic specimen remains in the collection at Kew, and others exactly agreeing with it were sent by the late Mr. Lea from Ohio. These, however, run so gradually into *P. perennis*, that there is some doubt about the stability of the species, notwithstanding the enormous difference in the size of the pores. Fries informs us that this is *P. parvulus*, Klotzsch. *P. connatus*, Fr. and Weinman is a totally different species.
331. *P. RADICATUS*, Schwein. Specimens of this very distinct species, with the pileus varying from 1½ inch to 5 inches across, and the stem from 1½ to 9 inches long and ½ to 1½ inch thick, were sent from Ohio by Mr. Lea. Allied certainly, as Schweinitz himself hints, to such species as *P. ciliatus*, Fr., though immensely larger.
332. *P. VARIUS*, Fr.
333. *P. BADIUS*, P. A form of *P. varius*, Fr., growing to a large size, with the stem

not black as far as the pores, but only half way up. Such specimens occur in great beauty in Ohio.

334. *P. LUCIDUS*, Fr.=*P. Curtisii*, Berk.

341. *P. GRAVEOLENS*, Schwein! This is the same thing with *P. conglobatus*, Berk., and a most extraordinary and magnificent species. It is, however, by no means "durissimus," though it forms a compact close mass, but the texture is as soft and velvety as that of *P. fomentarius*. This circumstance, and the very different smell of the Schweinitzian and Ohio specimens, led to the notion that the latter was a distinct species. The odor of the former is described as oppressive and nauseous, whereas the specimens of Mr. Lea, though clearly identical, had a most attractive smell like that of strawberries. This grateful odor is found also at times in the Southern specimens, which we have heard compared to that of the flowers of *Calycanthus*, and that of the Water Beetle.

343. *P. LABYRINTHICUS*, Schwein! A very fine species, remarkable for its coarse, tow-like texture.

344. *P. SPUMEUS*, Fr. According to Fries (Nov. Symb. p. 39) this is *P. fusco-albus*. The specimens in Herb. Schwein. are nearly destroyed.

345. *P. BETULINUS*, Fr.

346. *P. CHIONEUS*, Fr.

347. *P. DESTRUCTOR*, Fr. The specimens are marked with a note of interrogation, and we think them somewhat doubtful, though clearly belonging to the same section. The substance is yellowish, and it may possibly belong to some undescribed species.

348. *P. LACTEUS*, Fr. The specimens are too much worm eaten for allowing any satisfactory decision, but they do not seem to belong to *P. lacteus*.

349. *P. STYPTICUS*, Fr. Nearly destroyed and unfit for comparison with our authentic specimens.

350. *P. MOLLIS*, Fr.

351. *P. CÆSIUS*, Fr.

354. *P. ALUTACEUS*, Fr.

355. *P. FIMBRIPORUS*, Schwein! Brown when dry.

357. *P. FUMOSUS*, Fr. Certainly not *P. fumosus*, but apparently a state of *P. annosus*.

358. *P. UNDULATUS*, Fr.

360. *P. NIGROPURPURASCENS*, Schwein! This highly curious species belongs to the

genus *Glæoporus*, Mont. It seems identical with what Dr. Montagne has sent from the south of France under the name of *P. dichrous*, P. ; but specimens from Fries under that name are more like *P. adustus*, so that there is some doubt about the species. It should be observed that Fries considers this to be merely a state of *P. isabellinus*, Schwein., which we did not find in the Herbarium.

361. *P. AMORPHUS*, Fr.

362. *P. ADUSTUS*, Fr.

363. *P. CRISPUS*, Fr.

364. *P. ULMARIUS*, Fr. = *P. scruposus*, Fr.

366. *P. POPULINUS*, Fr. The Schweinitzian specimens were found on an apple tree, and are undoubtedly distinct. They may be characterized as follows :

TRAMETES MALICOLA, Berk. et Curt., imbricatus, ligneus; pileis dimidiatis posticé decurrentibus subvillosis subzonatis, ligneo-umbrinis; poris mediis dissepimentis crassis subtomentosis.

It differs clearly in the far larger pores, darker pileus, &c.

370. *P. PILOTÆ*, Schwein. ! This is apparently the same thing with *P. hypococcinus*, Berk., the differences arising rather from age, or from the greater perfection of the Ohio specimens. No mention of bright showy colors is made by Schweinitz, except in the qualified phrase "intus subrutilans."

374. *P. VELUTINUS*, Fr. = *P. hirsutus*, Fr.

375. *P. NIGROMARGINATUS*, Schwein. ! Merely a state of *P. hirsutus*.

378. *P. STEREOIDES*, Fr. We are not acquainted with the species of Fries, but the Schweinitzian specimens are the same with *P. pergameneus*, Fr. ! = *P. Menandianus*, Mont.

379. *P. RADIATUS*, Fr. var. *carpineus*. Certainly the same with *P. scruposus*, Fr. !

380. *P. PALLESCENS*, Fr. Of this we have only fragments. One with a hirsute pileus is *P. hirsutus*, another may be the true plant.

381. *P. ABIETINUS*, Fr. The same with 378. The true species of this name occurs in the Herbarium with the ticket marked "*P. poroides*—*pinicola*, L. v. S." and is very common in the U. States.

382. *P. VIRGINEUS*, Schwein. ! The specimens are totally different from the original species, being densely villous. They are the same with a slight variety of *P. Sullivantii*, Mont., which occurs in S. Carolina. The species, however, which we have from more than one source is very distinct.

383. *P. CONCHIFER*, Schwein. ! The true species exists in Hook. Herb., and is most beautiful and distinct, differing in character and habit from every thing else. Very fine specimens were gathered by Mr. Lea in Ohio. The Schweinitzian specimens before us seem to be a discolored state of *P. virginicus*, of which however we have seen no authentic specimens.

385. *P. DECIPIENS*, Schwein. ! (marked *P. affinis*.) This has larger pores than *P. versicolor*, and is of a yellowish tinge, but still is not a very well marked species.

386. *P. PARVULUS*, Schwein. There is no species of this name in the Herbarium, but the plant mentioned above under 381 ("*P. poroides*—*pinicola*") is probably the one intended under the present number.

387. *P. SCUTELLATUS*, Schwein. ! A very curious species, extremely well described, but not closely allied to any published species except *P. compressus*, Berk., a Swan River Fungus.

388. *P. SANGUINEUS*, Fr.

389. *P. CINNABARINUS*, Fr.

393. *P. BENZOINUS*, Fr. Authentic specimens from Fries are totally different from this, which has the colors of such species as *P. radiatus*, *scruposus*, &c. It is indeed very closely allied to the former, from which it differs in its larger size and less yellow substance. It can therefore retain the name of *P. fusco-gilvus*, originally given to it by Schweinitz, and by which it is ticketed in the Herbarium. But our specimens are not sufficiently good to allow of our drawing up a specific character, and possibly it may be identical with *P. cuticularis*, Fr.

395. *P. NIDULANS*, Fr.

396. *P. CUTICULARIS*, Fr. Not the true plant of Fries. It is clearly a form of his *P. conchatus*.

397. *P. RUTILANS*, Fr.=*P. scruposus*, Fr. Schweinitz himself says, "an *carpineus*," and it is certainly the same with No. 379.

398. *P. GILVUS*, Schwein. ! (Hook. Herb.) Sir W. J. Hooker's specimens are *P. scruposus*, Fr., but Fries must have received something very different under this name.

399. *P. MARGINATUS*, Fr.

401. *P. ANNOSUS*, Fr. Certainly not the plant of Fries, but more like *P. igniarius*, which perhaps it may be, though our notes and recollection of the specimen are imperfect.

402. *P. DRYADEUS*, Fr. Not the European species, from which it differs evidently



in its rhubarb-colored substance and minute pores; and in the latter character it differs also from *P. dryophilus*, Berk. The Schweinitzian plant is, as we believe, only a form of *P. scruposus*. Specimens exactly similar were gathered by Mr. Lea in Ohio.

409. *P. LOBATUS*, Schwein. This is one of the specimens missing from the Herbarium. It must be very different from the Friesian homonym.

410. *P. PINI CANADENSIS*, Schwein.! Certainly the same with *P. hypococcinus*, Berk. See above, No. 370.

411. *P. SPONGIOSUS*, Fr. The plant of Fries is a resupinate form of *P. nidulans*, such as occurs in Scotland, which this certainly is not. The pores are too large to allow of its being a state of *P. igniarius*, but our materials are scarcely sufficient for arriving at any distinct opinion. *P. spongiosus*, Klotsch, Herb. viv. Myc. No. 2, is the same production.

414. *P. FERRUGINOSUS*, Fr.

416. *P. SALICINUS*, Fr.

417. *P. SUBSPADICEUS*, Fr. We are unacquainted with the Friesian species.

418. *P. SPISSUS*, Schwein. This species, of which there are authentic specimens in Hook. Herb., is totally different from the Friesian plant, which we believe that we have from S. Carolina. The pores have the same resinous appearance as in *P. Pilotæ*, Schwein. In the Schweinitzian Herbarium it is marked *P. rufus*.

419. *P. UNDATUS*, P. This differs from the plant of Persoon, of which we have an authentic fragment, in the far larger pores. In color it agrees with it.

420. *P. NIESKYENSIS*, P.

421. *P. UMBRINUS*, P. Certainly not the same with *P. obliquus*. We cannot distinguish it from *P. ferruginosus*.

422. *P. JUGLANDINUS*, Schwein.! Certainly different from *P. spissus* of Hook. Herb.

423. *P. VITICOLA*, Schwein.! Resembles *P. contiguus*, and perhaps not really different, though totally distinct from *P. superficialis*.

424. *P. XANTHUS*, Fr. Totally different from authentic specimens of the Friesian species, but exactly agreeing with a specimen under the same name from Desmazières, except that it is not at present stratose. It somewhat resembles resupinate forms of *P. annosus*, except that the pores are smaller. We have the true *P. xanthus* from S. Carolina.

425. *P. NITIDUS*, Fr. We have two species under this name,—one from Schweinitz' earlier collections, which appears to be a state of his *P. nigro-purpurascens*, and the other with long pores, very different from an authentic specimen now before us. This was formerly called *P. croceus* by Schweinitz, but that name is preoccupied. We beg to substitute

*P. CROCIPORUS*, n. sp.;—totus resupinatus; poris minutis longis tenuibus, extus intusque croceo-fulvis, mycelio pallido molli oriundis.

The pores are just the color of dried saffron, and have somewhat the same appearance as those of *P. spissus*. The mycelium is pale, thin, of a rather soft texture and confluent with the matrix.

426. *P. PULCHELLUS*, Schwein. The same with *P. xanthus*, Schwein.! Herb. As *P. pulchellus* was formerly called *P. xanthus* by Schweinitz, it is possible that we have not got what he ultimately intended by that name, and which may therefore be the true plant.

428. *P. INCARNATUS*, Fr. The young state of some *Glæoporus*.

430. *P. RHODELLUS*, Fr. Not the true plant of Fries, as appears from an authentic specimen. It looks like an early stage of *P. spissus*, Schwein.! in Hook. Herb.

431. *P. UNITUS*, Fr. The Schweinitzian specimens are precisely the same with No. 418.

432. *P. VITELLINUS*, Fr.

434. *P. SINUOSUS*, Fr. We have no authentic specimens of this species.

435. *P. XANTHOLOMA*, Schwein.! Very distinct.

436. *P. RHODODENDRI*, Schwein.! Very like *P. Stephensii*, Berk., which has been found on *Taxodium* by Mr. Ravenel. This differs in its thinner dissepiments and obscure tint.

437. *P. SASSAFRAS*, Schwein.! Schweinitz describes this in his Herbarium as having "pori majusculi," which agrees with the specimen; whereas the printed character says "poris minutis." It is probably a distinct species.

438. *P. SUPERFICIALIS*, Schwein.! An authentic specimen from Prof. Torrey's Herbarium has nothing like "poris latiusculis," and we believe is identical with No. 439.

439. *P. NIGRO-PURPUREUS*, Schwein.!

440. *P. CINEREUS*, Schwein.! The specimens of this, as of some others among the omitted numbers, are destroyed.

441. *P. CARYÆ*, Schwein.! Resembling somewhat *P. xantholoma*, but with rather larger pores.
442. *P. PAPYRACEUS*, Schwein.! Pores rather large; resembles *P. Stephensii*, Berk.
444. *P. MEDULLA PANIS*, Fr.
445. *P. TUBERCULOSUS*, Fr. Apparently a *Radulum*.
446. *P. VITREUS*, Fr. The specimens belong to *P. vulgaris*.
447. *P. VULGARIS*, Fr. Not the true species, but closely allied to *P. pulchellus*, Schwein., only with smaller pores. We can see no other difference. The same Fungus occurs in Ohio and N. Carolina.
448. *P. CALCEUS*, Fr.  $\beta$ . A curious production, resembling somewhat a *Porothelium*, but scarcely in a normal condition.
449. *P. CALLOSUS*, Fr. The specimens are hardly distinguishable from *P. pulchellus*, Schwein., and do not answer to the description of Fries. We have, however, the Friesian species from S. Carolina.
451. *P. COLLICULOSUS*, P. We are not acquainted with this species.
452. *P. OBDUCENS*, P. This is not in the least degree stratose. The pores are a line long. It appears to us to be very near to *P. xantholoma*.
453. *P. DENTIPORUS*, P. Very much after the fashion of *P. vaporarius*, and indeed scarcely to be distinguished.
455. *P. TERRESTRIS*, Fr. This is scarcely the plant of Fries, and perhaps is undescribed.
456. *P. TENUIS*, Schwein.! Resembling *P. vaporarius*, but more uniform. What was referred to this species in the account of Mr. Lea's Ohio Fungi is something with much broader and shallower pores, and is scarcely developed fully.
457. *P. MUCIDUS*, Fr.
458. *P. RADULA*, Fr. Certainly *P. vaporarius*.
459. *P. MICANS*, Fr. Another form of *P. vaporarius*.
461. *P. SANGUINOLENTUS*, Fr. There are two things under this number. One is the same with 430; the other answers exactly to *P. reticulatus*, Fr.
462. *P. MOLLUSCUS*, Fr. The sulphur-colored variety of which Schweinitz speaks is much in the fashion of *P. reticulatus*, and is probably undescribed.
463. *P. FARINELLUS*, Fr. Our specimens of this are nearly destroyed by insects.

464. *P. ANEIRINUS*, Fr. The specimens are not quite certain, but the species occurs in a highly developed state in S. Carolina.

465. *P. XYLOSTROMEUS*, P. Two things are in the Herbarium under this name: the one appears to be merely a state of *P. vaporarius*; the other is a species of *Merulius*. See below under No. 500.

469. *P. INTERNUS*, Schwein.!

471. *P. RETICULATUS*, Fr. This appears to be certainly *P. farinellus*, of which we have fine specimens from S. Carolina. It has not a byssoid margin, nor are the pores distant.

\**P. BRUNNEUS*, Schwein.! New York. This appears to be the same with *P. crocatus*, Fr., which is very near to, if not identical with, *P. cupreus*, Berk.

473. *POROTHELEUM SUBTILE*, Fr.

475. *P. PEZIZOIDES*, Schwein.! This species differs from *P. fimbriatum* only in the absence of the marginal threadlike processes. There is a species in Hook. Herb. from Schweinitz marked *Boletus obliteratedus*.

476. *DÆDALEA BIENNIS*, Fr. = *Polyporus rufescens*, Fr.

480. *DÆDALEA ABIETINA*, = *Lenzites abietina*, Fr.

481. *D. TRABEA*, = *Lenzites trabea*, Fr.

483. *D. PINI*, Fr. The specimens belong to *Lenzites sepiaria*, perhaps from an accidental change of the label.

486. "*D. AN GIBBOSA*?" = *Lenzites Berkeleyi*, Lev.

490. *D. ANGUSTATA*, Fr.

491. *D. AUREA*,  $\beta$ . *FERRUGINEA* = *Lenzites sepiaria*, var.

492. *D. ZONATA*, Schwein.! This is considered by Fries to be *D. variegata*. Our specimens are too imperfect to allow us to form any judgment on the point.

494. *D. MERULIOIDES*, Schwein. This is a *Paxillus*, but our notes upon the specimens are too meager to enable us now to recal the species.

495. *MERULIUS TREMELLOSUS*, Fr. The plant in Hook. Herb. from Schweinitz, under the name of *M. tremelloides*, seems nearer to *M. fugax*, of which we have very fine specimens from S. Carolina. It is accompanied by *Sclerotium rugulosum*, (No. 2436,) and therefore must be what Schweinitz intended. See that number.

496. *M. STRIGOSO-ZONATUS*, Schwein.! This is *Phlebia zonata*, B. & C., a very distinct species.

497. *M. RUFUS*, Fr.
498. *M. SERPENS*, Fr. Nearly destroyed, with no rugæ. It looks like a *Corticium*.
499. *M. CRISPATUS*, Fr. This is clearly a form of *M. corium*. *M. crispatus* resembles *Cantharellus crispatus*.
500. *M. PALLENS*, Schwein.! Very nearly allied to *M. corium*. The specimens of *Polyporus xylostromeus*, Schwein.! strongly resemble this.
501. *M. FUGAX*, Fr. Specimens destroyed.
504. *M. VASTATOR*, Fr.=No. 497. *M. vastator* is a synonym of *M. lacrymans*.
505. *M. MOLLUSCUS*, Fr. Specimens in bad condition.
506. *M. HIMANTIOIDES*, Fr. The specimens belong to *M. Brassicæfolius*, Schwein., a name not preserved in the Herbarium.
507. *M. PORINOIDES*, Fr. We have fine specimens of this species from Ohio. It occurs also in S. Carolina. Schweinitz' specimens are all but barren, and the slight trace of incipient folds indicates rather a state of *M. Corium* or *M. serpens*.
511. *HYDNUM SUBSQUAMOSUM*, Fr.
514. *H. RUFESCENS*, P.
517. *H. CANUM*, Schwein.!
518. *H. DELICATUM*, Schwein.! Nearly destroyed.
519. *H. COMPACTUM*, Fr.
521. *H. FERRUGINEUM*, Fr.
522. *H. CINEREUM*, Fr.
523. *H. CYATHIFORME*, Fr. (Hook. Herb.) Teeth white, slightly discolored.
524. *H. CONNATUM*, Schultz. The Schweinitzian specimens have not a shining stem, and do not seem to differ from *H. zonatum*, Batsch.
526. *H. CORIACEO-MEMBRANACEUM*, Schwein.! A very singular and distinct species.
528. *H. ADUSTUM*, Schwein.! The specimens nearly destroyed; but the species is common and well ascertained.
530. *H. CORALLOIDES*, Scop.
537. *H. STRIGOSUM*, Sw.
538. *H. OCHRACEUM*, P.
539. *H. RHOIS*, Schwein.! The specimens indicate a true *Hydnum*, to which, perhaps, *H. flabelliforme*, Berk., is too near. That in Hook. Herb., if identical, has rather the structure of a *Polyporus*.

540. *H. OLIVACEUM*, Schwein.! The specimens belong to *Irpex cinnamomeus*.
541. *H. MACRODON*, P. The species of Persoon is but little known. The Schweinitzian specimens closely resemble *H. mucidum*.
542. *H. MEMBRANACEUM*, Fr. The Schweinitzian specimens are altogether different from the Friesian. In fact we do not find the species which they represent described, and therefore characterize it as follows: *H. Schweinitzii*, B. et C., papyraceum, album, a matrice omnino solubile; aculeis sparsis subulatis, basi abrupte dilatatis.
543. *H. FUSCO-ATRUM*, Fr.
544. *H. FERRUGINOSUM*, Fr.
545. *H. MICRODON*, P. The original plant is a subterranean species, altogether omitted in the Epicrisis. The fragments of the Schweinitzian plant before us seem to agree fully with *H. membranaceum*, Bull.
546. *H. ALUTACEUM*, Fr. This is very different from the plant of Fries, of which we have authentic specimens. It seems to be a young state of *H. udum*.
547. *H. FASCICULARE*, A. and S.
548. *H. MUCIDUM*, P. Extremely different from authentic specimens. It appears to be the true *H. alutaceum*.
550. *H. OBTUSUM*, Schrad. Very near to *H. alutaceum*. Unknown to Fries.
551. *H. CRUSTOSUM*, Fr. Identical with No. 546.
553. *H. NIVEUM*, P. Very near to *H. farinaceum*.
554. *H. SUBCARNACEUM*, Fr.
555. *H. SULPHUREUM*, Schwein.!
556. *H. VITICOLA*, Schwein.! Fries considers this only a form of *H. mucidum*; but the specimens in Herb. Schwein. are totally distinct from that species. The spines are not connected at the base by any mucedinous matter.
557. *H. SUBRESUPINATUM*, Schwein.! Certainly not a good *Hydnum*; but our specimens are so devoured by insects that we can get no distinct notion of the species.
558. *H. HIMANTIA*, Schwein.! A very beautiful species which we have also from Sweden, gathered by Lindblad.
559. *H. BYSSINUM*, Schwein.!
560. *H. EPIPHYLLUM*, Schwein.! A curious species in the style of *H. ferruginosum*, with short granules rather than spines, and perhaps belonging to *Odontia* rather than to *Hydnum*.
561. *H. SQUALINUM*, Fr. Our specimens are young and imperfect.

563. *H. ÆRUGINOSUM*, Schwein.! Apparently distinct, but our specimens are in a wretched condition.

564. *H. FIMBRIATUM*, P.= *Odontia fimbriata*, Fr.

565. *H. SPATHULATUM*, Fr. Quite different from Schweinitz' specimens under this name in Hook. Herb. It appears to be some *Polyporus* with lacerated dissepiments.

566. *H. QUERCINUM*, Fr. This is perhaps *Irpex obliquus*, Fr.; certainly not *Radulum quercinum*. Some states of *I. obliquus* are, however, very difficult to distinguish from *Pol. vaporarius*.

569. *H. STIPATUM*, Fr.

570. *H. CINNABARINUM*, Schwein.! This is the same with *Odontia albo-miniata*, B. and C., and is only a peculiar condition of *Pol. cinnabarinus*.

571. *H. CROCEUM*, Schwein.! A well marked species.

572. *H. LUTEO-PALLIDUM*, Schwein.!

574. *IRPES PALEACEUS*, Fr. This does not agree with the plant of Thore; it is rather *I. fusco-violaceus*.

575. *I. FUSCO-VIOLACEUS*, Fr. The specimens are merely a state of *Pol. pergameus*, Fr., *P. stereoides*, Schwein.!

276. *I. LACTEUS*, Fr. Our specimens are in such a state that we can say nothing positive about them.

578. *I. EPIPHYLLA*, Schwein.! This is without any question *Pol. biformis*, Kl. We have collected specimens precisely similar extending from stumps over fallen leaves.

579. *I. TULIPIFERÆ*, Schwein.!

580. *I. FUSCESCENS*, Schwein.! = *I. cinnamomeus*, Fr. The specimens of *Hydnum olivaceum*, Schwein.! are the same with this.

583. *I. CERASI*, Fr. = *I. paradoxus*, Fr. The pores, however, are more developed than in our authentic specimen, and the dissepiments thinner.

584. *I. SPATHULATUS*, Fr. We have no doubt that the specimens belong to *Pol. vaporarius*. Fries says of *I. spathulatus*, "nunquam porosus," which does not at all apply to the plant before us. Indeed there is no resemblance between it and a Swiss specimen from Trog.

585. *I. OBLIQUUS*, Fr.

586. *I. DEFORMIS*, Fr.

587. *I. NIVEUS*, Schwein.! Fries considers this very near *I. deformis*.

589. *RADULUM ORBICULARE*, Fr. (Hook. Herb.)



590. *R. MOLARE*, Fr. This cannot be the true species. It appears more probably to be a state of *Kneiffia setigera*, but our specimens are in a very unsatisfactory condition.

591. *R. FAGINEUM*, Fr.

592. *R. LÆTUM*, Fr. Certainly not *R. lætum*, but apparently a form of *R. molare*.

593. *R. BOTRYTES*, Fr. Certainly not the plant of Fries. Whether a good species or not we can scarcely determine from our much decayed specimens.

595. *R. PINI CANADENSIS*, Schwein.!

596. *R. HYDNANS*, Schwein.! Very nearly allied to *H. molare*, but brightly colored and with very short teeth.

597. *R. INVESTIENS*, Schwein.! Connecting *Radulum* and *Corticium*. It resembles indeed some states of *C. læve*.

598. *PHLEBIA MESENERICA*, Fr. *Auricularia*, Fr. Epicr.

600. *P. RADIATA*, Fr. Deeper colored than 602.

601. *P. VAGA*, Fr.

602. *P. CINNABARINA*, Schwein. != *P. radiata*, Fr.

603. *P. COCCINEO-FULVA*, Schwein.!

604. *P. HYDNOIDEA*, Schwein.! A very singular Fungus, perhaps abnormal from being grown within a hollow trunk.

605. *THELEPHORA CANTHARELLA*, Schwein.! A *Craterellus*. It was gathered in Ohio by Lea, and is *Craterellus lateritius*, Berk. in Herb.

606. *T. PANNOSA*, Fr. We have never seen the true plant of Persoon. The Schweinitzian specimens accord with the figure in some measure, but without authentic specimens it is very difficult to judge. They look like a mesopod form of *T. biennis*.

607. *T. REGULARIS*, Schwein.! Resembles somewhat *T. anthocephala*.

608. *T. CARYOPHYLLÆA*, = *T. laciniata*, P.

609. *T. MULTIPARTITA*, Schwein.! (Hook. Herb.) Very distinct.

610. *T. VIALIS*, Schwein.! Very distinct.

611. *T. CORALLOIDES*, Fr.

612. *T. PALMATA*, Fr.

613. *T. TUBEROSA*, Grev.

614. *T. FLABELLARIS*, Fr.

616. *T. FIMBRIATA*, Schwein.! In Hook. Herb. is a very different thing resembling *Corticium læve*.

617. *T. CANDIDA*, Schwein. !

618. *T. CLADONIA*, Schwein. !

619. *T. PALLIDA*, Schwein. ! Very common throughout the United States.

620. *T. CÆSPITULANS*, Schwein. !

621. *T. CRISTATA*, Fr. The American species is very different, and is perhaps only a state of *T. pallida*. Several of the Schweinitzian species have not occurred in the more recent investigations.

623. *T. SERRATA*, P.

624. *T. TERRESTRIS*, = *T. caryophyllæa*, Fr.

625. *T. LACINIATA*, P. This has very little resemblance to the true plant, and is in fact the same with No. 627, *T. biennis*.

627. *T. BIENNIS*, Fr.

629. *T. GAUSAPATA*, Fr.

630. *T. ALBIDO-BRUNNEA*, Schwein. !

631. *T. LUTOSA*, Schwein. !

632. *T. BICOLOR*, P. (Hook. Herb.) In Herb. Schwein., this species is found under the name of *T. brunnescens*, from Indiana.

633. *T. RUBIGINOSA*, Schrad.

634. *T. TABACINA*, Fr.

635. *T. CROCATA*, Fr. This has not so deep a rhubarb tint as authentic specimens from Fries, but it differs from the two foregoing species, and is perhaps a form of that to which Schweinitz refers it.

636. *T. LEPROSA*, Fr. = *T. Curtisii*, Berk.; whether the same with *T. leprosa*, Fr., a Brazilian species, we are unable to say positively.

637. *T. IMBRICATULA*, Schwein. ! This seems a distinct species and undescribed by modern authors, though some half dozen nearly allied forms are published.

638. *T. ATRATA*, Swartz. Authentic specimens, of which a figure may be seen in Annals of Nat. Hist., vol. X. tab. 11, are totally different. The plant of Schweinitz is very beautiful; but as the hymenium is not formed, it is impossible to describe it. We shall hope to have some future opportunity of making it generally known.

639. *T. VERSICOLOR*, Swartz, var. *fasciata*, Schwein. ! An extremely common

species, of which we have numerous specimens. Schweinitz seems to have included *T. lobata*, Kze, which is common in the subtropical parts of the United States.

640. *T. SPADICEA*, P. Only a variety of *T. hirsuta*.

641. *T. RUGOSA*, P.

642. *T. STYRACIFLUA*, Schwein.! Resembles, as Fries says, *T. hirsuta*; but the upper surface is smooth, or only obscurely silky, besides other characters.

643. *T. HIRSUTA*, Willd.;  $\beta$ . *ramealis*, Schwein.! = *Stereum complicatum*, Fr. Specimens marked *T. Gatesii*, in the Herbarium, are the same species.

644. *T. OCHROLEUCA*, Fr. Our specimens are so bad that it is difficult to say to what they belong; but they are certainly not the plant of Fries, of which we have an authentic specimen, and which occurs in various parts of the United States.

646. *T. SANGUINOLENTA*, A. and S. Rather thicker than British specimens, and approaching *T. spadicea*.

647. *T. STRIATA*, Fr. Common throughout North America.

648. *T. GRISEA*, Schwein. This was not found in the Herbarium.

649. *T. OCHRACEO-FLAVA*, Schwein.! A beautiful species, resembling in color *Corticium ochraceum*. Much paler than any form of *Stereum hirsutum*, and far less coriaceous.

650. *T. SUBZONATUM*, Schwein. = *Corticium subzonatum*, Fr. Epicr.

651. *T. CINERASCENS*, Schwein.!

652. *T. EVOLVENS*, Fr. The specimens exhibit something very different from the authentic specimens of Fries. It is doubtful whether they are any thing more than *Corticium læve*.

654. *T. SALICINA*, Fr. We have never seen authentic specimens of this curious species, but there can be no doubt that the plant of Schweinitz is the same with that of Fries.

655. *T. QUERCINA*, P. It is scarcely possible that Schweinitz should not have been acquainted with this common European species. We have no specimen from Bethlehem. That from Florida is in too bad a state for determination, but is evidently something totally different, more, in point of fact, in the way of *S. spadiceum*.

657. *T. ABIETINA*, P. The specimens are not on the wood of any Conifer. They are very bad, but appear to belong to *T. papyrina*, Mont.

658. *T. RUFA*, Fr. We have no authentic specimens, and cannot therefore say

whether the reference is right. The species, however, in the Schweinitzian Herbarium, if not belonging to that of Fries, which is very doubtful, is evidently distinct. It has no rufous tinge. The species, which has occurred in several localities, is marked in our collections *Corticium molle*, n. sp.

661. T. ALBOBADIA, Schwein.! The label has *T. albomarginata* erased upon it.

662. T. DISCIFORMIS, D. C. The specimens exhibit a resupinate disciform state of *T. quercina*. The true species occurs at least in Canada.

663. T. CANDIDISSIMA, Schwein.! (Hook. Herb.) marked *T. candida*. A beautiful and distinct species; = *Stereum candidum*, Fr.

664. T. FRUSTULATA, Fr. (Hook. Herb.,) where it is marked *Sphaeria*.

665. T. PALLESCENS, Schwein.! Resembling *Corticium lactescens*, Berk., but strongly setulose, like *C. giganteum*, and very thick.

666. T. INSINUANS, Schwein.! A distinct but coarse species.

667. T. AREOLATA, Fr. Except in color, this resembles *Cort. polygonium*. The true plant is much harder and more woody.

668. T. HELVELLOIDES, Schwein.! The thick spongy substance of this species is very curious, reminding one of *Pol. obducens*. Though the hymenium looks like that of an *Helvella*, there are no asci.

669. T. SPONGIOSA, Schwein.! This seems rather to be a mycelium than an autonomous species. Fries has, however, probably seen better specimens.

671. T. RETICULATA, Fr. See No. 703.

672. T. BYSSOIDES, P. This appears to be the same with No. 700.

673. T. OLIVACEA,  $\beta$ . botryoides, Schwein.! Fries considers Schweinitz right in making this curious production a variety of *T. olivacea*. It is our *T. granosa*.

674. T. SISTOTREMOIDES, = *Odontia Sistotremoides*, Fr. Epicr.

675. T. FERRUGINEA, P.

676. T. PUNICEA, A. and S. The specimens are not in the least reflexed; but we have no authentic example with which to compare them.

677. T. RUBRO-PALLENS, Schwein.!

679. T. COCCINEA, = *Hypochnus rubrocinctus*, Ehrh.

680. T. LILACINA, Schwein.! Scarcely more than a form of *Cort. cinereum*.

681. *T. CINNAMOMEA*, P. Scarcely the plant of Persoon and Fries; apparently a resupinate form of *Stereum rubiginosum*.

682. *T. PEDICELLATA*, Schwein.! This grows on bark of living trees, and is probably not a true Fungus, but a state of some Lichen.

685. *T. STRIGOSA*, P. A mere mycelium; omitted by Fries in the *Epicrisis*.

686. *T. VIOLASCENS*, Fr. Not the true species, but closely resembling *Cort. cinereum*.

687. *T. ATROVIRENS*, Fr. Similar specimens occur in England, but we have never seen a perfect hymenium.

688. *T. CÆRULEA*, Schrad. In Hook. Herb., under the name of *T. indigo*, Schwein.

690. *T. SULPHUREA*, Fr. With a perfect hymenium.

691. *T. VITICOLA*, Schwein.! (Hook. Herb.)

692. *T. LACTEA*, Fr. Very different from the true plant. Probably only a state of *Cort. Sambuci*.

694. *T. ANTHOCHROA*, Fr. With the true plant is mixed up an obscure white species which appears to be a form of *Cort. calceum*.

695. *T. ODORATA*, Fr. Very different from authentic specimens. The original name *T. alutacea*, ought to be retained for the species, for it seems distinct. It is a *Corticium*.

696. *T. SETIGERA*, Fr. The plant of Fries now forms the genus *Kneiffia*. The plant of Schweinitz is either a blanched state of *Corticium velutinum* or distinct. The only difference, however, is one of color.

697. *T. BOMBYCINA*, Sommf. (*T. sera* of Syn. Car.) It is a well developed state of *Cort. sulphureum* and is marked by Schweinitz *Coniophora sulphurea*.

698. *T. PAPILLOSA*, Fr. This is not a *Grandinia*, for there is not the slightest appearance of granules. It is perhaps only a form of *Cort. læve*.

699. *T. GIGANTEA*, Fr. Very doubtful. It is in fact the same with *T. viscosa* from Mauch Chunk, which is so marked by Schwein. in Herb.

700. *T. INCRUSTANS*, P. (*T. sebacea*, Fr.)

701. *T. CALCEA*, Fr. Not the plant of Fries. Far more nearly allied to *Stereum acerinum*, a form of which is very common in Carolina on trunks of Cedar.

702. *T. PUBERA*, Fr. Beautiful specimens of this have been received from Ohio.

The hymenium is not setulose, and Schweinitz was right at first in thinking it distinct. It is, we believe, the same with *Cort. Auberianum*, Mont.

703. *T. MOLLIS*, Fr. Identical with No. 871, which should be referred here.

704. *T. ALNEA*, Fr.

705. *T. OCHRACEA*, Fr.

707. *T. GRANULOSA*, P. This again is no *Grandinia*, and is probably merely a form of *Cort. læve*, or possibly of *C. incarnatum*.

709. *T. SERIALIS*, Fr. Very doubtful.

710. *T. LIVIDA*, P. This is not the same with authentic species from Fries. It appears to be a resupinate state of *Cort. quercinum*.

711. *T. VISCOSA*, P.

712. *T. CONFLUENS*, Fr. Merely a form of *Cort. læve*.

713. *T. COMEDENS*, Nees. If the specimens are named correctly, the hymenium is much more developed than in European individuals; but we have scarcely sufficient materials to determine what is the habit of Schweinitz' plant.

714. *T. INCARNATA*, Fr. Color very slightly developed.

715. *T. NUDA*, Fr. Certainly not the true plant. It resembles much more thicker conditions of *Cort. cinereum*, such as are often found on Ash twigs.

716. *T. CINEREA*, Fr.

717. *T. ALBIDO-CARNEA*, Schwein.! A very distinct species with the substance yellowish. Our *Cort. chrysocreas* is a more highly developed form.

718. *T. POLYGONIA*, P.

719. *T. RIBESIA*, Fr. Scarcely a distinct species; apparently *Cort. incarnatum*.

720. *T. ACERINA*, Fr. Not the true plant; appears to be *Cort. calceum*.

721. *T. CORRUGATA*, Fr.

722. *T. LÆVIGATA*, Fr. The difference between this and No. 681 is very slight. It is very doubtful whether it is what Fries intends. It does not appear to take its origin beneath the cuticle like *Cort. comedens*, which is essential to the species.

723. *T. EPISPHERIA*, Schwein.!

724. *T. MACULÆFORMIS*, Fr.

725. *T. BUFONIA*, P.

726. T. AMPHIBOLIA, Fr.

727. T. EPIDERMEA, P.

The following should be added to No. 374 :—

There is in the Hookerian Herbarium a species from Schweinitz marked *Sistotrema velutinum*, and we have the same from Prof. Torrey's collection of Schweinitzian Fungi marked *Polyporus velutinus*, which is probably the plant intended under No. 374. It does not, however, accord with numerous authentic specimens from Fries, and we propose for it the name of *Pol. Richardsonii*, as it occurs in his collections from the higher northern regions of America.

P. RICHARDSONII, n. sp.; pileo reniformi disco tantum affixo, subtiliter depressotomentoso ruguloso leviter zonato albido; poris parvis.

A few species from Surinam were overlooked in our Exotic Fungi, which are here appended :—

CANTHARELLUS SPATHULARIA, Schwein. ! MSS. = *Guepinia Spathularia*, Fr.

C. SURINAMENSIS, Schwein. ! MSS. = *Cladoderris dendritica*, P.

"SCHIZOPHYLLUM RAMOSUM (novum)," Schwein. MSS. = a multipartite *L. commune*.

CLAVARIA ADMIRABILIS, Schwein. ! MSS. is the same as the preceding.

POLYPORUS SANGUINEUS, Fr.

The following very beautiful species was confounded in our Exotic Fungi, No. 4, (Journ. Acad. Nat. Sc., ii. p. 278) with *P. modestus*, Kze., which, however, is very near to *P. affinis*, if the specimen in Weigelt's *Exsiccata* is rightly named :

POLYPORUS CERVINO-NITENS, Schwein. ! MSS. pileo flabelliformi tenui radiato-rugoso plicatove ligneo-coriaceo sublobato cervino-fulvo zonis crebris obscurioribus sericeo-striato; hymenio contextuque subconcoloribus dilutioribus; poris minimis. Surinam.

Pileus flabelliform, 2 inches high, above 2 inches broad, thin, of a hard coriaceous substance, slightly lobed, attenuated behind into an obscure stem, radiato-rugose or plicate, sericeo-striate, of a bright tawny fawn-color, approaching to brick-red, with narrow darker zones, margin very thin. Substance and the bordered hymenium paler, pores punctiform, very minute.

The following should be inserted in its place, No. 408 :—

408. P. MICROPORUS. Florida. Gathered by Le Conte. The same species was sent to Sir W. J. Hooker under the name of *P. Floridanus*. The pores are superficial and punctiform, and the whole plant resembles strongly such productions as *P. byrsinus*, Mont., which is, we believe, only a state of *P. occidentalis*, Kl.



ART. XVIII.—*Synopsis of the MELOLONTHIDÆ of the United States.*

By JOHN L. LE CONTE, M. D.

The Melolonthidæ form a group of the family Scarabæidæ less distinctly defined than any other in that extensive family; connecting with several others, it seems to be the great central group, and embraces genera of such diverse form and structure, as to render the attempts at classification not altogether satisfactory. Erichson was the first to attempt a general arrangement of the tribe, and Lacordaire, while following nearly in his path, has introduced some important changes. It would ill become me, having studied only a fauna limited in genera of this type, to pronounce upon the value of the affinities thus displayed between genera which I have never seen; but I have found great difficulty in placing in the schemes of those authors a new genus, which should evidently have place within the limits embraced by them.

The classification of Burmeister is founded upon entirely different characters, and seems at first to give much more natural groups than those formed by Erichson and Lacordaire, though the characters used seem by no means distinct or easy of application. The great stumbling point in both systems is however the curious mixture of characters found in the allied group Anthobia of Burmeister, part of which forms Erichson's family Glaphyridæ, enrolled in the great series of Scarabæi laparosticti. Burmeister having examined (Lamell. 2, 2d, 467) the position of the abdominal stigmata in the genera of Erichson's Glaphyridæ, found great variations between the individual genera, some having them as in Melolonthidæ, while in none had they exactly the situation in which they are found in the other groups of Laparosticti. From these facts he draws the inference that the family Anthobia as established by him is a natural one, osculant between the Phyllophaga (Melolonthidæ and Rutelidæ of Erichson) and Melitophila (Cetoniadæ of Erichson), entirely denying the relationship with the Laparosticti.

While admitting the probable justice of the latter result, although Erichson notes the transition from Phænognatha to Hybosorus, I must say that the facts seem to me to bear a very different interpretation. Looking for example at the four primary groups into which Erichson divides the Scarabæi pleurosticti, the reader will see that the Melolonthidæ have the posterior stigmata diverging but feebly, while the three others have them diverging strongly. We will afterwards see that the position of

the posterior pair in the groups of genuine Melolonthidæ varies. Why, then, may not all these cases of variation, great or small, in the position of the stigmata be brought together in one large group, which may be placed between the pleurosticti and laparosticti, connected more closely with the former than with the latter. The essential character of this large group seems to be the negation of the characters of the other two; and we would thus have the following expression of relations:

Stigmata abdominis in segmentis ventralibus sita postice fortiter divergentia, ultima conspicua . . . . .	Laparosticti.
Stigmata abdominis parum divergentia, variabiles, at in membrano non sita, ultima sæpe conspicua . . . . .	Melolonthidæ.
Stigmata abdominis in membrano inter segmenta ventralia et dorsalia sita, ultima obtecta	Pleurosticti.

Besides this difficulty in determining the limits and characters of the entire family, some difference in observation appears to result from the nature of the characters used in its division. Thus, for example, the ventral segments of the Sericidæ are described as free by Erichson and Lacordaire, and as connate by Burmeister; the sutures are in reality distinct, though probably immovable. Nevertheless, although so deceptive, this character cannot in the present condition of the study be abandoned, though perhaps something may be done to render it more reliable.

Modifying the tables of Erichson and Lacordaire to suit the introduction of the new views enunciated above, and omitting the groups not found in our territory, the following table may be formed:

#### I. Mandibulæ sub clypeo tectæ.

##### A. Coxæ anticæ transversæ haud prominulæ.

###### Parapleuræ latæ.

Segmenta abdominis haud connata . . . . .	1. Macrophyllæ.
Segmenta abdominis suturis oblitteratis . . . . .	2. Melolonthæ.
Parapleuræ angustæ . . . . .	3. Rhizotrogi.

##### B. Coxæ anticæ conicæ prominulæ.

###### Parapleuræ angustæ vel mediocres; tarsi onychio distincto; tibiæ posteriores bicalcaratæ.

###### Abdomen segmentis ventralibus haud connatis:

segmentum sextum haud conspicuum . . . . .	4. Diplotaxes.
segmentum sextum conspicuum.	

Labrum connatum . . . . .	5. Sericæ.
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###### Labrum distinctum:

ungues divergentes, fixi . . . . .	6. Macroductyli.
ungues mobiles, cheliformes . . . . .	7. Dichelonychæ.

Abdomen segmentis ventralibus arcte connatis . . . . .	8. Lasiopodes.
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###### Parapleuræ magnæ.

Tarsi onychio nullo; tibiæ unicalcaratæ vel ecalcaratæ . . . . .	9. Hopliæ.
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#### II. Mandibulæ ante clypeum conspicuæ.

Parapleuræ maximæ (abdomen segmentis liberis) . . . . .	10. Glaphyri.
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## 1. MACROPHYLLÆ.

A group having the epimera and parapleuræ of the metathorax broad as in *Melolonthæ*, but differing by the ventral segments not being connate, although the sixth is less closely articulated. Besides this character, the long slender tarsi, and the very long hair of the head, thorax and sides, enable them to be readily recognized. The group has heretofore had no representative on the American continent, but I am now enabled to make known a new genus found within our territories.

Characters derived from the abdomen, and not mentioned by Burmeister or Lacordaire are the very distinct and straight fissure-like suture between the fifth ventral segment and the propygidium; the stigma is situated on the ventral segment, near the anterior margin, but remote from the suture just mentioned.

The group in its present form was established by Lacordaire. It consists of the group *Tanyproctini* of Erichson, less the genus *Tanyproctus*.

Burmeister combines with it Erichson and Lacordaire's group *Pachypodii*, which differ not only by the variable characters derived from the less development of the oral organs, but by the epimera of the metathorax being narrow.

## PHOBETUS Lec.

Corpus ovatum, convexum alatum, margine omni pectoreque longe villosa, elytris abdomineque subglabris. Caput clypeo rotundato margine reflexo, sutura frontali fere oblitterata. Labrum transversum late concavum, parum emarginatum. Mandibulæ obtusæ prominulæ. Mentum medio impressum; palpi labiales articulo ultimo cylindrico (maxillares desunt.) Antennæ 9-articulatæ, articulo 1mo (scapo) elongato, 2do rotundato, 3io 4to æqualibus, 5to obliquo haud brevior, 6to transverso brevi, clava triarticulata, (maris) funiculo paulo longiore. Thorax antice linea marginali profunda. Abdomen haud marginatum, segmento quinto ventrali longiore margine postice subcoriaceo; pygidium triangulare, magnum convexum. Tibiæ breves, anticæ bidentatæ, denteque superiore munitæ, longius unicalcaratæ; posteriores spinulis longioribus unicoloratæ, posticæ crassiores et denticulo superiore munitæ, omnes longe pilosæ. Tarsi tibiis fere duplo longiores, tenues, verticillatim setosi, articulis subæqualibus, unguiculis versus apicem dente magno lato acuto armatæ, et ad basin iterum subdentatæ.

Seems to be allied to *Tryssus* *Er.* and *Trichiodera* *Burm.*, but the latter has 10-jointed antennæ; the former has, it is true, 9-jointed antennæ, but is very insufficiently described, and being from southern Africa can hardly be the same as the present genus.

1. *P. comatus*, capite obscuro confluentè dense punctato, clypeo rotundato fortiter marginato, thorace luteo-ferrugineo margine omni longissime flavo-piloso, lateribus valde rotundatis, confertim punctato, elytris piceo-testaceis nitidis, margine laterali et basali flavo-pilosis, vix obsolete punctatis, stria suturali profunde exarata, propygidio dense subtilius punctato pubescente, pygidio nitido parce piloso et punctulato; subtus ferrugineus, femoribus tibiis posterioribus et pectore longe pilosis. Long. .67.

One specimen found in California by Mr. J. Wittick, probably near Sacramento, and given me by Mr. S. S. Rathvon. The thorax has a strong marginal line at the

apex, and a faint fovea near the side at the middle; the anterior angles are acute. The oral organs, sides of the head, and base of the antennæ are also provided with long hairs.

## 2. MELOLONTHÆ.

This group differs from the others by the combination of the following characters: five ventral segments of the abdomen are connate, with nearly effaced sutures, the 6th is distinct and rounded; the parapleuræ of the metathorax are broad and their epimera are large.

The latter important character was first observed by Lacordaire, (Gen. Col. 3, 292), but has been overlooked by Burmeister, who distributes the contents into two groups, Leucopholidæ having the third joint of the antennæ short, and Polyphyllidæ having the same joint elongated. The new genus *Thyce*, while important as being the second generic representative of the group on this continent, is still more important, as showing the greater correctness of the view taken by Lacordaire, since with the habit and structure of head and feet of *Polyphylla*, it combines the antennæ of *Leucopholis*.

Additional characters common to our two genera, but which, though apparently of importance, are not mentioned in the generic descriptions of Burmeister, are, that the middle tibiæ, instead of being surrounded externally by two more or less developed crowns of spines, (as in all *Rhizotrogidæ*), are acutely bidentate; the posterior tibiæ of *Polyphylla* are similar to the middle ones; in *Thyce* the inferior prominence is transverse; the suture between the fifth ventral segment and the propygidium is distinct, angulated at the middle, with the stigma placed exactly upon the angle; the thorax is not margined anteriorly, and is ciliate with short bristles.

Our two genera are very distinct, and may be thus known:

Antennarum articulo 3io longiore, clava polyphylla . . . . .	<i>Polyphylla</i> Harris.
Antennarum articulo 3io haud longiore, clava parva (♀) triphylla . . . . .	<i>Thyce</i> Lec.

### POLYPHYLLA Harris.

#### A. Tibiæ maris anticæ fortiter tridentatæ.

1. *P. Hammondi*, oblonga, fusca, supra parce albo-squamosa, thorace brevi lateribus oblique rotundatis, antrosum angustato, canaliculato, trivittato, margine postico longe comato, elytris parce punctatis, sutura anguste, vittaque brevi basali densius albo-squamulosis, ano, antennis pedibusque ferrugineis. Long. .82—1.0.

Two males found at Fort Riley, Kansas, by Dr. Wm. A. Hammond, U. S. A. to whom I owe my most grateful acknowledgements for a very large and complete series of the Coleoptera of that region.

Body oblong, somewhat cylindrical, blackish brown, shining, above very sparsely

sprinkled with small white scales. Clypeus (as in the males of this division) deeply concave, with the sides oblique and diverging anteriorly, margin broadly reflexed, truncate in front, and reddish; vertex with long yellowish hair. Antennæ ferruginous, club much longer than the head. Thorax nearly three times wider than long, sides rounded and oblique, not narrowed towards the base, margin reddish, disc with a dorsal channel which being clothed with denser white scales forms a narrow vitta, another short interrupted vitta is seen each side, but in one specimen is very indistinct; the disc near the anterior margin is furnished with a few long hairs; the surface is shining and sparsely punctured; the posterior margin is fringed with long hair. Scutellum with a white medial line. Elytra shining sparsely punctured, with a very narrow sutural line, and a short basal vitta inside of the humerus more densely clothed with white scales, the vitta disappears in one specimen. Abdomen clothed with small white scales more condensed at the posterior margin of the segments, anus ferruginous. Pectus clothed with dense long hair, legs ferruginous; anterior tibiæ armed with three acute teeth.

2. *P. cavifrons*, oblongo-cylindrica, fusco-ferruginea, pube brevi pallida squamulosa parce vestita, thorace lateribus rotundatis, utrinque angustato, sulco dorsali, plaga utrinque basali densius pubescentibus, margine basali brevius fimbriato, elytris rugosis obsolete tricotatis et vix vittatis, sutura paulo densius pubescente. Long. .9.

Le Conte, Proc. Acad. Nat. Sc. Philada., 7, 222.

Sonora, Dr. Webb, and Mr. Schott, of the U. S. and Mex. Boundary Commission. Only males were procured. This species is slightly more cylindrical than the preceding, being about the same size and form as *P. variolosa*, of a reddish brown color and with a thin covering of short depressed yellow hair; the thorax is however of a different shape, being about two times wider than long, much rounded on the sides, and narrowed both in front and behind, the disc is moderately densely punctured, channeled, with the sides, dorsal vitta and basal spots more densely pubescent with fine short yellowish hair like scales. The anterior part of the disc has a few longer hairs, and the posterior margin is fringed with not very long hair. The head is formed as in the preceding, sparsely clothed with short yellowish hair, with long hair on the vertex; the antennæ are paler ferruginous with the club not much longer than the head. The elytra are finely rugous, not very shining, with three faint costæ, which appear with the suture more densely pubescent. The abdomen is densely clothed with yellowish scale like hairs, the pectus as usual with long yellow hair. The anterior tibiæ are armed with three acute teeth.

3. *P. subvittata*, cylindrica ferrugineo-testacea, parce pallide squamosa, thorace lateribus fere angulatis, utrinque angustato, canaliculato, trivittato, elytrorum sutura vittisque minus distinctis utrinque tribus albo-squamosis, vitta externa ambiente. Long. 1.10.

One mutilated male found by Mr. A. Schott on the Rio Grande, Texas. More

cylindrical than the preceding, and of a paler color, sparsely clothed with small white scales. Clypeus longer, with the sides more diverging, and the anterior angles more defined; vertex as usual with yellow hair. Thorax a little more than twice as wide as long, sides almost angulated, narrowed very much in front, and moderately behind, disc anteriorly without hairs, with the dorsal channel and a lateral discoidal vitta (as in the next species) more densely squamous; surface shining moderately punctured, posterior margin fringed. Elytra shining, coarsely rugous and punctured, with the suture and three vittæ each side more densely squamous; the two inner vittæ extend within one-fourth of the apex, the outer one is less distinct, but entire, and bends around the apex almost to the suture. Body beneath as in the preceding. Anterior tibiæ with three teeth which from wearing have become obtuse.

B. Tibiæ anticæ maris bidentatæ.

3. *P. decemlineata*, fusco-picea, parce sulphureo-squamosa, thorace canaliculato, vittis tribus, scutello medio, elytris sutura vittis tribus brevique humerali niveo-squamosis, antennis ferrugineis. Mas antennarum clava magna, clypeo truncato subemarginato antice paulo latiore. Long. 1.10. Femina, antennarum clava parva, clypeo parum concavo, lateribus parallelis, antice subsinuato, tibiis anticis tridentatis. Long. 1.05—1.35.

Lec. Proc. Acad. Nat. Sc. 7, 218. Burm. Lamell. 2, 2d, 407.

*Melolontha* 10-lineata Say, Journ. Acad. Nat. Sc. 3, 246.

Kansas, Nebraska and New Mexico; shores of Tlamath Lake, Oregon, Dr. Newberry; a specimen of very large size was found by Mr. Joshua Child in the Sierra Nevada of California. The head behind is clothed with moderately long hair, but hardly any is seen on the thorax; the yellow scales on the latter near the margin are elongate, but on the disc they are lanceolate, and about twice as long as their width; the sides are obtusely angulated at the middle, with the posterior angles very obtuse. The yellow scales of the elytra are acute, and a little more than twice as long as their width. The under surface is clothed with pale scales with snowy bands across the abdomen; the pectus is very hairy, the posterior tibiæ are internally clothed with long hair. The feet vary from ferruginous to blackish.

A male found in Kansas is remarkable for the right antenna bifurcating at the end of the second joint; the inner third joint is thick and short, the outer normal; the outer club is normal, but smaller than the one of the opposite side; the inner club is deformed, being composed of two which are fused together at the middle, forming a concave mass, of which the upper laminæ are much longer than the under ones. The anterior tibiæ are almost without teeth.

4. *P. crinita*, fusco-picea, pube depressa vix squamulosa pallide sulphurea parce vestita, capite postice, thorace antice longius crinito, hoc canaliculato, niveo trivittato, scutello medio elytris sutura, vittis tribus humeralique brevi niveis, pygidio sæpius, pedibus antennisque ferrugineis.

Mas antennarum clava magna, clypeo recte truncato, thoracis margine postico longe villosa. Long. .97—1.17.  
Femina antennarum clava parva, clypeo antice subsinuato, thoracis margine postico brevius villosa, tibiis  
anticis tridentatis. Long. 1.05—1.35.

Oregon, Washington Territory and California. So similar to the preceding that the females might be readily confounded; on comparison, however, I find the following differences independent of sex. The yellow scale-like hairs are lanceolate, and narrow, being on the elytra about four times as long as their width; on the disc of the thorax especially in the vittæ they are broader, but towards the margins they are elongated, and are gradually converted into long hairs, which towards the apex are as long as those on the back of the head: the sides of the thorax from a dorsal view appear rounded, and not angulated.

The base of the thorax of the male is densely fringed with long yellowish hair, about three-fourths as long as the scutellum, but in the female the hair is not longer than in both sexes of *P. 10-lineata*. The under surface is as in the preceding; the legs are however ferruginous in every specimen before me: the margin of the elytra, the pygidium and last ventral segment are also usually ferruginous.

The study of the genus *Lachnosterna* indicates that in this tribe species may be really distinct, although almost without differences in form and sculpture, otherwise I should not venture to distinguish the present by a specific name, but should rather class it as a race of *P. 10-lineata*.

5. *P. variolosa*, fusco-ferruginea, undique minus dense albido-pubescent, capite postice villosa, thorace antrorsum fortius angustato, lateribus oblique magis rotundatis, angulis posticis obtusis, canaliculato pubescentiore subtrivittato, elytris, sutura anguste, guttis pluribus densius pubescentibus. Long. .8—9.  
Mas antennarum clava magna, clypeo concavo antice latiore fere recte truncato, thorace margine basali medio longe villosa.

Femina haud visa.

Harris Ins. Inj. Vegetation, 1st ed. 30.

*Melolontha variolosa* Hentz, Trans. Am. Phil. Soc. 3, 256, pl. 2, fig. 5. Harris, Ins. Inj. Vegetation 2nd ed. 28.

Middle States, Massachusetts, New Jersey. This species seems to have been confounded by Erichson and Burmeister with the following, to which it bears but little resemblance; or at least the name has been quoted as a synonym, without any knowledge of the object or figure to which it referred. Apart from the want of regular vittæ on the elytra, the pubescence is much less dense, the occiput clothed with long hair, the thorax is shorter, and more narrowed anteriorly and more rounded on the sides, the body is less elongated, and much less cylindrical than in the next species. The abdomen is sometimes fuscous, sometimes reddish brown, with bands of whitish pubescence.

6. *P. occidentalis*, elongata, cylindrica ferrugineo-testacea densius pallide pubescens, thorace antrorsum parum angustato, lateribus rotundatis, angulis posticis rectis, vitta dorsali alba, alteraque utrinque



sæpe obsoleta, scutello toto, elytris sutura vittisque tribus densius albo-pubescentibus, interna sæpe abbreviata. Long. .9—1.3.

Mas antennarum clava magna, clypeo lateribus subrectis, antice latiore recte truncato, tibiis anticis bidentatis.

Femina antennarum clava parva, clypeo lateribus rotundatis, antice subsinuato, tibiis anticis fortius bidentatis.

Er. Ins. Deutschl. 659; Burm. Lamell. 2, 2nd, 408.

*Scarabæus occidentalis* Linn. Syst. Nat. ed. 12ma reformata, 1, 2, 555.

*Melolontha occidentalis* Herbst, Käfer, 3, 72; tab. 23, fig. 8. Drury, Ins. 2, 58; tab. 32, fig. 2. Oliv. Ins. 5, 15, tab. 1, fig. 7, (in part.)

Southern States, S. Carolina, Louisiana. The abdomen is usually blackish with transverse bands of denser white pubescence. The hair of the base of the thorax is distinct but not longer in the male than in the female.\*

#### THYCE Lec. *scab. 62m*

Corpus oblongo-cylindricum, alatum, squamulosum, pectore villosa, elytris subglabris. Clypeus concavus, antice paulo latior, recte truncatus. Antennæ 10-articulatæ, articulis 3 et 4 æqualibus, clava (feminæ) parva triphylla. Labium profunde excavatum. Mentum paulo concavum, ligula latior. Palpi labiales in margine ligulæ inserti: maxillares articulo ultimo longiore cylindrico ad apicem acuto. Mandibulæ parum prominulæ. Tibiæ anticæ fortiter tridentatæ, intermediæ extrorsum acute bidentatæ, posticæ crassiores denticulo 1mo acuto, denteque secundo transversa armatæ, ad apicem spinulis coronatæ, calcaribus complanatis, interno minore angustiore. Tarsi (postici) breves, verticillatim setosi, articulis 1—4 sensim paulo brevioribus, 5to primo æquali, unguiculis medio dente acuto mediocri armatis. Pygidium subtransversum triangulare, angulis rotundatis.

In every respect resembling *Polyphylla*, except in the antennæ, the more thickened posterior tibiæ, and the ungues.

1. *T. squamicollis*, piceo-ferruginea, capite thoraceque confertissime punctatis, pilis depressis squamiformibus pallidis vestitis, hoc convexo, disco antice posticeque parcius villosa, elytris nitidis punctatis et rugosis parce brevissime pubescentibus, pygidio abdomineque squamulosis, pectore dense villosa. Long. 1.03.

One female collected by T. Charlton Henry, M. D., U. S. A., at Albuquerque, New Mexico.

Uniform reddish brown, with the tibiæ darker. Head densely punctured covered with narrow yellowish scales; front broadly margined, sides straight, slightly diverging, anterior margin nearly straight. Thorax convex, narrowed in front, much rounded and subseriate on the sides, feebly broadly channeled about the middle of the disc, vaguely impressed each side near the anterior angles: densely punctured, covered with small narrow scales like those of the head, with long hairs intermixed towards the base and apex. Scutellum densely pubescent with a glabrous line. Elytra rugous as in most *Rhizotrogi*, not densely punctured, with a very short hair from each puncture. Pygidium densely, abdomen less densely clothed with very small whitish

\* Fabricius has intended by his *Melolontha occidentalis* the European *Anoxia australis*; Olivier confounded them together as is evident by the localities given. His description does apply to the present, as the seven-jointed antennal club of the male is mentioned.



scales. Pectus densely clothed with long yellowish hair. Femora and inner margin of the posterior tibiæ fringed with long hair.

### 3. RHIZOTROGI.

These are distinguished among the other Melolonthidæ with transverse not prominent anterior coxæ, by the deeply emarginate labrum, the anteriorly margined thorax without apical membrane, the narrow parapleuræ, and the connate ventral segments. Specimens, and perhaps even species occur in which this last character is not very obvious.

Additional characters, not previously noticed are: the 5th ventral segment is joined with the propygidium by an angulated suture, which is sometimes partly obliterated, the stigma is placed upon the suture at the angle, and nearer the posterior than the anterior margin.

The last joint of the maxillary palpi is frequently impressed and sometimes deeply excavated, the ungues and mandibles seem to vary in form within the same genus. In the native genera the posterior coxæ are entirely corneous, without any posterior membranous margin: the posterior external angle is sometimes produced; the antennæ are 9 or 10-jointed, with the club three-jointed.

Our genera may be thus arranged:

Unguiculi haud serrati, prope medium dentati;

Ligula profunde emarginata;

Antennæ 10-articulatæ . . . . . *Eugastra Lec.*

Antennæ 9-articulatæ . . . . . *Endrosa Lec.*

Ligula fere truncata;

Labrum bilobum . . . . . *Lachnosterna Hope.*

Labrum concavum, haud bilobum . . . . . *Gynnis Lec.*

Unguiculi plus minusve serrati, nonnunquam ad medium dentati; ligula fere truncata *Listrochelus Blanch.*

#### EUGASTRA Lec.

Corpus crassum, convexum, sexus utriusque apterum, supra et subtus glabrum. Labrum bilobum; mandibulæ prominulæ, maxillæ validæ ad apicem dentatæ. Ligula parum concava, antice profunde subquadratum emarginata. Palpi maxillares articulo ultimo elongato, levissime obovali, labiales articulo ultimo ovali. Antennæ 10-articulatæ, articulis 3—6 subæqualibus, 7mo brevior, haud latior; clava sexus utriusque parva triphylla. Tibiæ posteriores coronatæ, tarsi tibiis paulo longiores, setosi, postici articulo 1mo vix brevior; unguiculis dente acuto prope basin armatis; calcaribus posticis sexus utriusque liberis. Abdomen segmento ventrali ultimo feminae prominulo, maris brevi; penultimo maris æquali, feminae transversim impresso.

This genus represents on this continent the apterous Rhizotrogi of the group Geotrogus, but differs from that genus by many characters. The deep emargination of the ligula is bisinuous but almost square at base, and will readily distinguish this from all the other genera of the tribe.

1. *E. cribrosa*, brevis inflata, purpureo-picea, thorace varioloso; antice ad medium paulo deplanato, elytris connatis, subreticulatis, longitudinaliter obsolete sulcatis. Long. .65.

Le Conte, Proc. Acad. Nat. Sc. Philadelphia, 7, 217.

*Tostegoptera cribrosa* Lec. ibid. 6, 231.

Texas, valley of the Rio Grande; collected by Messrs. Schott and Clark, of the U. S. and Mexican Boundary Survey. Body convex, stout, ovate in the female, oblong in the male, purplish black. Head scabrous, flat, finely margined, faintly emarginate in front; frontal suture not visible. Thorax nearly twice as wide as the head, sides much rounded, serrate, sparsely ciliate, narrowed towards the base; disc very coarsely and confluent punctured, at the middle slightly flattened, with some smooth polished spaces around the flattened portion. Scutellum transverse, smooth. Elytra ventricose, subsulcate, and covered with shallow foveæ, giving a reticulated appearance, suture not more elevated than the rest. Pygidium sparsely coarsely punctured. Body beneath shining; sternum very coarsely punctured, with very short hairs proceeding from the punctures; sides and the abdomen sparsely punctured and slightly hairy.

2. *E. ventricosa*, atra convexa, thorace lateribus rotundatis serratis, medio subangulatis, confertim grosse punctato, callo dorsali pone medium lævi, disco antice vix obsolete impresso, elytris connatis subsulcatis, confluentius minus profunde punctatis, interstitiis sublævibus. Long. .9.

Lec. Proc. Acad. Nat. Sc. Phil. 7, 217.

*Tostegoptera ventricosa* Lec. ibid. 6, 440.

Eagle Pass, Texas; two females collected by Mr. Schott. Differs from the preceding by the head being more rounded and less scabrous, with the frontal suture slightly visible; by the thorax being less coarsely but more densely punctured, and having a dorsal smooth space behind the middle. The elytra are more distinctly sulcate, and are rather punctured than reticulate. The body beneath is sculptured as in *Eu. cribrosa*.

#### ENDROSA Lec.

Antennæ 9-articulatæ, articulis 3—5 connatis, longitudine æqualibus, clava triarticulata; palpi maxillares articulo ultimo elongato, cylindrico, labiales articulo ultimo ovali; labrum bilobum, ligula (cum mento) subrotundata, concava, antice profunde acute emarginata. Mandibulæ crassæ prominulæ. Tibiæ posteriores coronatæ; tarsi elongati, postici articulo imo paulo brevioribus, unguiculi dente magno ad medium armati; calcaria postica sexus utriusque libera.

This genus is represented only by *Melolontha quercus* *Knoch*, and a new species having the appearance of the *Lachnosternæ* of group V, but differing in several respects, the principal of which are the emarginate clypeus and deeply incised ligula. The posterior spurs of the male are free, elongated, flattened and obtuse; the penultimate segment of the abdomen is protuberant and impressed at the middle, the last segment is short, and not impressed, as in the *Lachnosternæ* of division C.

1. *E. quercus*, cylindrica, testaceo-rufa, sericeo-pruinosa, capite thoraceque saturatioribus, illo fortiter haud dense punctato, clypeo anguste marginato, emarginato, thorace parce punctato, elytris parcius fortiter punctatis subcostatis, pygidio et propygidio subtilius punctatis, pectore parum pubescente. Long. .58—.63.

*Melolontha quercus* Knoch, Neue Beytr. 72, tab. 1, fig. 26.

*Melolontha fervida*† Illiger, ed. Oliv. 2, 44, (fide Burmeister.)

*Ancylonycha quercus* Burm. Lamell. 2, 2d, 340.

Middle and Southern States. The club of the antennæ of the male is as long as the stem.

2. *E. volvula*, cylindrica, rufo-testacea nitida, capite fuscesciente minus dense punctato, clypeo emarginato, thorace sat dense, elytris fortius punctatis haud costatis, pygidio parce subtiliter punctato, pectore vix pubescente. Long. .5.

One female, New York, Mr. Guex. Much smaller than the preceding, and very different by the shining and more punctured body.

#### LACHNOSTERNA Hope.

This genus commonly appears under the name *Ancylonycha*, and in the Catalogue of the Described Coleoptera of the United States is called *Phyllophaga*. After carefully examining the history of each of these names, I am convinced that a regard for the purity of nomenclature requires that they should be rejected, and the name proposed by Hope in 1837, (*Coleopterist's Manual*, 1, 99) should be restored.

The name *Ancylonycha*, the one best known, is used for the first time by Dejean, in the Catalogue of his Collection printed in 1833, but the characters were first published by Blanchard, in 1845, and the name was subsequently adopted by Erichson, Lacordaire, Burmeister, and all the leading entomologists of Europe.

Misled by a note in the first edition of Harris' *Insects of Massachusetts Injurious to Vegetation*, (p. 30,) the name *Phyllophaga* was adopted by Mr. Haldeman and myself in the *Melsheimer Catalogue*, as above stated, but by the kindness of a friend I have recently procured a transcript from the *Massachusetts Agricultural repository* cited by Harris, and find that the name, although proposed as early as 1826, is not accompanied by any description.\*

\* For the convenience of future students, I reprint the passage in which the name is proposed. Vide *Mass. Agricult. Repository*, vol. x. p. 6, (note.)

† The genus *Melolontha* as constituted by Fabricius contains a vast number of species, differing greatly in external appearance, and somewhat in modes of life. Fabricius describes 149 species, and Schönherr, after separating those which constitute the modern genera *Anisonyx*, *Glaphyrus*, *Amphicoma*, *Rutela*, and *Hoplia*, enumerates 226 species of *Melolontha*, to which additions are constantly making from the discovery of new species. Hence the genus requires further subdivision. The bases of these subgenera have been pointed out by Latreille, Knoch, and Schönherr, and some have already been established. I would restrict the name of *Melolontha* to those species which have more than three lamellæ to the club of the antennæ, like the *vulgaris* of Europe, and of which we have an indigenous example in the *M. decimlineata*, of Say, (*M. occidentalis* Herbst?). Our common species *quercina*, *hirsuta*, *hirticula*, *balia*, and some others might receive the generic name, *Phyllophaga*. *M. vespertina*

From this it is clear that the name *Ancylonycha* is the one entitled to least regard, since it the more recent, among the uncharacterized as well as among the characterized names.

The species are very numerous, and many of those recently discovered in the South Western territories of the United States present some very curious characters in the spurs of the posterior tibiæ, which render the establishment of several groups easy. The form of the unguis, and the prominence of the mandibles in a state of repose are characters subject to much variation. Following the example of Lacordaire I have suppressed the genus *Tostegoptera* Blanch. founded on *Mel. lanceolata* Say, and *Trichesthes* Er. as being distinguished by insufficient characters.

The species naturally divide themselves into four principal groups; of these the most numerous is distinguished by the inner spur of the posterior tibiæ being in the male connate with the tibiæ, and by the comparatively large sixth ventral segment being somewhat rounded in front so as to invade the fifth. These would seem to be characters of some importance, and a careful study of the species from Asia and South America may shew the necessity of regarding them as generic, in which case *Trichesthes* must be retained for division D; division A. will keep the name *Tostegoptera*, and C. if differing from the Asiatic species called *Holotrichia* by Hope must receive a new name. In that event, however, as at present the following grouping exhibits the relations of our native species.

- |                                                                                                                                                   |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| A. Unguis prope basin dentati; tibiæ posticæ calcaribus utriusque sexus liberis.                                                                  |          |
| I. Corpus squamulis vestitum; thorace postice haud angustato calcaribus posticis rectis                                                           | Sp. 1.   |
| II. Thorax ante basin latior; calcaribus posticis rectis, obtusis                                                                                 | Sp. 2—3. |
| III. Corpus supra glabrum; thorace ante basin latiore, calcaribus posticis contortis                                                              | Sp. 4.   |
| B. Unguis ad medium dentati; tibiæ posticæ calcare interno maris fixo, solido, (nonnunquam obsoleto); abdomen articulo ultimo ventrali majusculo. |          |
| IV. Palpi maxillares articulo ultimo sæpe ovali; antennæ 9-articulatæ; corpus cylindricum, supra glabrum                                          | Sp. 5—7. |

*sericea* and *iricolor* would form another sub-genus which might be called *Stilbolema*, unless they are included in *Serica* MacLeay, or *Omaloplia* of Megerle; the characters of their genera I have not seen. *M. pilosicollis*, *longitarsa*, and *moesta* of Knoch and Say should each constitute a subgenus. The latter (with *M. sordida* and *frondicola* Say?) belongs to Kirby's genus *Apogonia*. From the singular manner in which the nails are divided at tip, I would call the *linearis* of Schönherr *Dichelonyx*.'

*Ibid*, vol. x. p. 8. (Note.)

'*Stenothorax* would be an appropriate name for the subgenus having the *subspinosus* for its type.

*Scarabæus lanigerus*, Linnæus *Melolontha lanigera*, Fabr. has been referred to the genus *Rutela*; but Schönherr says it is not a *Rutela*, and arranges it between *M. fastuosa* and *M. aurata* F., belonging to the genus *Anomala*? it may therefore be considered as the type of a new subgenus. See Schönherr's *Synonymia Insectorum*, III. p. 504. *Scarabæus punctatus*, Lin., *Melolontha punctata* Fabr., or *Rutela punctata*, Latreille, belongs to Mr. MacLeay's genus *Pelidnota*.

*Melolontha varians* Fabr. is congeneric with the *Anomala vitis* of Megerle and Köppe.'

- V. Palpi maxillares articulo ultimo impresso; antennæ 10-articulatæ; corpus cylindricum, supra glabrum, capite magno. Sp. 8—13.  
 Palpi maxillares articulo ultimo tenui haud impresso.  
 α. Antennæ 10-articulatæ.
- VI. Tibiæ posticæ maris calcare interno obliquo; (corpus glabrum) Sp. 14.
- VII. Tibiæ posticæ maris calcare interno elongato contorto; (corpus glabrum, margine longe fimbriato) Sp. 15.
- VIII. Tibiæ posticæ maris calcare interno recto, (corpus supra glabrum, vix fimbriatum);  
 \* Thorax haud serratus; clypeus fortius marginatus, vix emarginatus Sp. 16—21.  
 \*\* Thorax serratus vel haud serratus; clypeus anguste marginatus, fortius emarginatus Sp. 22—30.  
 \*\*\* Thorax lateribus serratis medio angulatis Sp. 31—34.
- IX. Tibiæ sicut in VIII: corpus supra pubescens Sp. 35—38.  
 β. Antennæ 9-articulatæ.
- X. Clypeus emarginatus 39—45.
- XI. Clypeus integerrimus 46.
- C. Ungues ad medium dentati; tibiæ posticæ sexus utriusque calcaribus liberis gracilibus; abdomen articulo ultimo brevissimo; (antennæ 10-articulatæ); mandibulæ ad apicem conspicuæ.
- XII. Clypeus subemarginatus; species pubescentes Sp. 47—50.
- XIII. Species pruinosa Sp. 51—52.
- XIV.\* Clypeus integerrimus; species thorace piloso Sp. 53.
- D. Ungues intra medium breviter dentati, tibiæ posticæ sexus utriusque calcaribus liberis gracilibus; abdomen articulo ultimo brevi; mandibulæ occultæ; (antennæ 10-articulatæ) Sp. 53—55.

## GROUP I.

We have here a single species remarkable by the small scales which cover the surface. The male is winged, the female apterous and very obese in form. The antennæ are 10-jointed; the mandibles are prominent, and the last joint of the maxillary palpi is elongate and not impressed. The thorax is short, not narrowed at the base. The spurs of the posterior tibiæ are free in both sexes: the claws are long and slender and are armed with a sharp tooth near the base.

1. *L. lanceolata*, fusco-nigra, alutacea, opaca squamis sordide pallidis lanceolatis undique tecta, clypeo reflexo late rotundato, elytris lineis sæpe subdenudatis notatis, pectore villosa, pedibus obscure castaneis. Long. .52—.68.

*Melolontha lanceolata* Say, Journ. Acad. Nat. Sc. 3, 242.

*Tostegoptera lanceolata* Blanchard, Cat. Col. Mus. Paris, 149; Burm. Lamell. 2, 2nd, 356.

*Ancylonycha lanceolata* Lacordaire, Gen. Coleop. 3, 285.

Kansas and New Mexico, as far east as Fort Riley.

Male oblong, winged; with the club of the antennæ as long as the stem; the 2—4

\* Here may be placed a group containing *Trichestes cylindrica* Burm. from Cuba, distinguished by the 9-jointed antennæ, and very faintly emarginate clypeus; the maxillary palpi are slightly impressed and the body is cylindrical as in group V: the tooth of the unguis is short, and the club of the antennæ of the male is composed of four joints.

anterior segments of the abdomen with a medial short elevated crest, the fifth narrowly incised at the middle, the pygidium broad and flat; the spurs of the posterior tibiæ free long and slender, the tarsi very long.

Female ovate, apterous; more densely squamous, with the last ventral segment more prominent, and the pygidium more triangular, but also flat; the spurs of the posterior tibiæ shorter and broad.

#### GROUP II.

Contains species of a robust form and rather large size, having the body glabrous, or nearly so, above. The head is small, the clypeus broadly margined, and hardly or not at all emarginate. The antennæ are 10-jointed, the mandibles prominent, and the last joint of the maxillary palpi slender, not impressed. The thorax is widest at the middle, strongly narrowed in front, slightly so behind. The spurs of the posterior tibiæ are free in both sexes, but are very broad and obtuse: the claws are armed near the base with a long sharp tooth.

2. *L. æqualis*, ovata convexa, (femina aptera) piceo-nigra nitida, capite convexo scabro-punctato, clypeo concavo minus dense punctato, thorace fortiter sat grosse punctato, lateribus serratis rotundatis, pilis pallidis depressis parce vestito, elytris fortius punctatis haud costatis, pectore breviter dense villosa. Long. .8.

*Tostegoptera æqualis* Lec. Proc. Acad. Nat. Sc. 6, 440.

One female found by Mr. Schott, of the U. S. and Mexican Boundary Commission, at Eagle Pass, Texas.

The spurs of the posterior tibiæ are elongate, broad and flattened very much as in *L. lanceolata*, and the wings are rudimentary; but the pygidium is convex and strongly punctured, and the thorax is formed as in the next species; for this reason I have placed it in the present group.

3. *L. faretæ*, ovata convexa, alata, castaneo-rufa, glabra, capite fortiter dense punctato, clypeo late rotundato, lateribus anguste, apice latius marginato, thorace sat dense punctato, lateribus serratis ciliatis, elytris fortiter punctatis haud costatis, pygidio gibboso, parce punctato. Long. .75—.95.

New Braunfels, Texas, Mr. Lindheimer. Body ovate, inflated, convex, shining reddish brown. Head flattened on the disc, densely punctured; clypeus rounded and broadly margined in front, slightly so on the sides, and less densely punctured than the head. Thorax convex, twice as wide as the head, fimbriate and strongly serrate on the sides, strongly not very densely nor coarsely punctured. Scutellum with two groups of punctures. Elytra more coarsely and strongly punctured than the thorax, without any trace of dorsal costæ; the suture is broad and rugous. Pygidium of both sexes sparsely punctured and protuberant at the middle, though more acutely so in the female. Breast very finely and sparsely pubescent: abdomen with small depressed hairs.

Male with the club of the antennæ as long as the stem, the abdomen with a broad longitudinal impression not extending upon the last segment, posterior tibiæ with the spurs free, very broad, flat and obtuse: tarsi longer than the tibiæ.

Female with the abdomen not impressed; the posterior spurs as in the male, and the tarsi hardly longer than the tibiæ.

#### GROUP III.

This group is established upon a single species, having most of the characters of the preceding, but the form is oblong and the spurs of the posterior tibiæ are contorted (at least in the male) and not flattened. The antennæ are 10-jointed, the mandibles and palpi as in the preceding, the clypeus is strongly margined, hardly emarginate. The thorax is rounded on the sides and serrate, but only very slightly narrowed at the base. The breast is moderately hairy, and the claws are toothed near the base: the spurs of the posterior tibiæ of the male are free, the inner (lower) one is curved, almost in a semi-circle, and inserted on the edge of the tibia, the upper one is straight and prismatic, inserted upon the end.

4. *L. torta*, oblonga convexa, castanea nitida, capite dense punctato, clypeo fortius marginato vix emarginato, thorace lateribus serratis postice paulo angustato, confertim fortius punctato, elytris confertim punctatis, subrugosis, costis parum distinctis, pectore dense brevius flavo-villoso. Long. .83.

Two males collected in Texas by Messrs. H. Haldeman, and Lindheimer. The propygidium is opaque, sparsely punctured, the pygidium is shining, more strongly punctured and subtruncate at tip: the abdomen is tolerably strongly punctured.

The club of the antennæ of the male is hardly as long as the stem; the abdomen is longitudinally flattened, and the penultimate segment is roughened and slightly elevated transversely at the middle near the posterior margin; the inner spur of the posterior tibiæ is laterally inserted and curved in a semicircle, the outer one is shorter, pointed, thick and three sided: the tarsi are longer than the tibiæ.

#### GROUP IV.

This group consists of small cylindrical species, glabrous above. The head is large, the clypeus is entire in one species, and deeply emarginate in the others: the mandibles project beyond the labrum: the last joint of the maxillary palpi is oval, nearly pointed, not impressed externally in all but *volvula*, where it is cylindrical and slightly impressed. The antennæ are 9-jointed, with the joints 3—5 connate, the 6th slightly produced inwards. The last joint of the abdomen is tolerably large, merely flattened and not impressed in the males. The inner spur of the posterior tibiæ of the male is fixed, and straight in the species here described. The tarsi especially of the males are very long, and the claws are armed with a small tooth inside of the middle.

5. *L. frontalis*, elongata, cylindrica pallide testacea, capite fusco rude punctato, canaliculato, clypeo



valde concavo, emarginato, testaceo parce punctato, thorace brevi sat punctato, elytris fortius punctatis subcostatis, pectore densius villosus. Long. .52.

Platte River, Kansas Territory. Nearly allied to the next, but the head is more coarsely and less densely punctured, and the breast is more hairy. The form is a little more robust.

In the male the club of the antennæ is as long as the stem, the abdomen is slightly flattened longitudinally, and the penultimate segment has a small posterior lunate impression at the middle; the inner spur of the posterior tibiæ is very small and fixed, but the outer one is long and flattened.

In the female the pygidium is less convex and more triangular, and the inner posterior spur is about one-half as long as the outer one, but more slender.

6. *L. longitarsis*, elongata, cylindrica pallide testacea, capite fusco confluentur punctato, fronte parce punctato, testaceo, valde concavo, emarginato, thorace brevi sat punctato, elytris fortius punctatis subcostatis, pectore parce piloso. Long. .47.

*Melolontha longitarsis* Say, Journ. Acad. Nat. Sc. Philadelphia, 3, 242.

Illinois, Mr. Willcox: only males were procured, and in their sexual characters they precisely resemble the preceding species.

7. *L. dispar*, cylindrica rufo-testacea nitida, æqualiter fortius sat dense punctata, capite fusco, clypeo parcius punctato, rotundato valde concavo, elytris subcostatis, pectore parum pubescente. Long. .45.  
*Trichestes dispar* Burm. Lamell. 2, 2nd, 361.

Southern States. More robust than the preceding, and approaching in form those of the next group. Burmeister describes the male as fuscous on the upper surface; the only two specimens in my collection are males, but are of a reddish yellow color both above and beneath; only the head is dark.

The club of the male is longer than the stem of the antennæ; the three anterior segments of the abdomen are longitudinally impressed and the last segment is slightly swollen: the pygidium is slightly transverse and strongly punctured; the inner spur of the posterior tibiæ is fixed, one-half the length of the outer, which is slender.

#### GROUP V.

Containing cylindrical species having the body glabrous above, and beneath only slightly pubescent, even on the breast. The head is large, being scarcely one fourth narrower than the thorax; the clypeus is strongly margined, sometimes entire, sometimes emarginate. The mandibles project beyond the labrum when closed. The last joint of the maxillary palpi is variable in form, but is always more or less oval, and flattened or impressed along the outer part. The antennæ are 10-jointed, with the joints 3—5 connate and indistinct, the sixth and seventh are slightly produced inwards. The thorax is remarkably broad, not narrowed behind, nor serrate on the sides. The last joint of the abdomen is relatively smaller than in the other groups having the inner posterior spur of the male fixed, but in the male is impressed and emarginate.

The inner posterior spur of the same sex is fixed, very small, and sometimes vanishes entirely. The unguis is armed with a short acute tooth just behind the middle. The legs, and especially the tarsi of the male are longer than usual.

8. *L. latifrons*, cylindrica, purpureo-nigra, nitida, clypeo rotundato marginato, ad apicem prominulo, capite thoraceque minus dense punctatis, elytris subpruinosis fortius punctatis, obsolete costatis, antennis palpisque rufis. Long. .66—.70.

New York; only females seen. Larger than the other species of this group, above and beneath of a shining purplish black; antennæ and palpi pale, tarsi dark rufous. Head flat, not densely punctured; clypeus longer than usual, more closely punctured than the head, rounded, narrowly margined on the sides, more broadly in front, with the apex prominent in a very slight angle. Eyes small, distant. Thorax one third wider than the head, and punctured like it. Elytra slightly pruinose, strongly punctured, with faint traces of the costæ. Breast strongly densely punctured, clothed with sparse short whitish hair. Abdomen sparsely but strongly punctured at the sides and apex; penultimate segment faintly transversely impressed. Pygidium tolerably densely punctured. Spurs of posterior tibiæ (female) long and nearly equal.

9. *L. cerasina*, cylindrica, purpureo-rufa, parum nitida, capite parcius punctato, clypeo fortius marginato, late submarginato, thorace elytrisque modice punctatis, his subcostatis. Long. .65.

One male, Georgia. Similar in form to the preceding, but with the sides of the thorax less rounded; uniform purplish rufous, not very shining. Head and clypeus sparsely, not strongly punctured, the latter strongly margined, very broadly but faintly emarginate, so as to appear scarcely more than truncate at tip. Thorax moderately punctured. Elytra rather more strongly punctured than the thorax, with faint traces of costæ. Propygidium punctured at tip. Pygidium finely punctured. Breast densely punctured, clothed with fine short hair. Sides of the abdomen finely and sparsely punctured.

Male with the club of the antennæ much longer than the stem, and the abdomen faintly channeled; the penultimate segment has a faint posterior excavation at the middle, and two transverse obtuse elevations; the last segment is deeply foveate and rises at the tip into two slight cusps; the outer spur of the posterior tibiæ is long and slender; the inner one is completely wanting.

10. *L. ephilida*, cylindrica rufo-testacea nitida, capite thoraceque obscurioribus, illo dense fere confluentem punctato, clypeo fortius marginato, late emarginato, thorace sat dense, elytris fortius punctatis, obsolete costatis. Long. .70.

*Melolontha ephilida* Say, Journ. Acad. Nat. Sc. 5, 196.

*Trichestes ephilidia* Burm. Lamell. 2, 2d, 359.

Georgia and New York; only males observed. Differs from the next by the more densely and finely punctured head, less deeply emarginate clypeus, and by the somewhat more robust form.

Male with the club of the antennæ shorter than the stem; the abdomen obsoletely channeled; penultimate segment broadly but suddenly emarginate at the middle and roughened with transverse elevated points; last segment broadly transversely foveate, emarginate at tip, with two obtuse cusps.

11. *L. Burmeisteri*, longior, cylindrica, rufo-testacea nitida, capite obscuriore, sat dense punctato, clypeo fortius marginato, parce fortius punctato late emarginato, thorace fortiter haud dense punctato, elytris fortius punctatis, subcostatis. Long. .62.

*Trichestes longitarsis*† Burm. Lamell. 2, 2d, 359.

One male found at New York. This species bears no resemblance to Say's *Melolontha longitarsis*, but is very closely allied to the preceding, from which it differs chiefly by the clypeus being sparsely punctured and more deeply emarginate, and by the body being more slender.

The male has the club of the antennæ shorter than the stem; and the abdomen and posterior tibiæ precisely as in the preceding species.

12. *L. glaberrima*, longior, cylindrica, rufo-testacea nitida, capite obscuriore, parcius fortiter punctato, clypeo emarginato, fortius marginato, parce punctato, thorace parcius punctato, elytris fortius punctatis, obsolete costatis. Long. .58.

*Ancylonycha glaberrima* Blanch. Cat. Col. Mus. Paris, 136.

Georgia. This species has precisely the form of the preceding, but the head is more coarsely and less densely punctured.

The male has the club of the antennæ longer than the stem; the abdomen faintly channeled, the penultimate segment faintly impressed and roughened at the middle, with the posterior margin not emarginate as in the two preceding, with a very slight oblique discoidal elevation each side towards the middle; last segment with a very deep round fovea, bounded each side by an elevated ridge, which, however, hardly rises into a cusp, as in *L. cerasina*. Posterior tibiæ with the terminal fringe of spines longer than usual, with the inner spur distinct, but not larger than one of the spines; outer one long, slender.

A female which I refer to this species has the head much smaller, being only two-thirds the breadth of the thorax, the eyes small and distant, and the spurs of the posterior tibiæ long and nearly equal.

13. *L. inana*, subcylindrica, testacea nitida, capite rufescente, parcius punctato, clypeo emarginato, fortius marginato, thorace sat punctato, lateribus suberenatis, elytris fortius punctatis haud costatis. Long. .45.

One female, New York, Mr. Guex. Much smaller than the preceding, but similar to it in characters; nevertheless, the clypeus and thorax and elytra are more punctured, the scutellum is strongly punctured, and the elytra are not costate, even near the margin. The pygidium is subtriangular, shining and sparsely punctured. The breast is very slightly pubescent, and the claws are armed with a small tooth at the

middle. The penultimate ventral segment is faintly impressed transversely, and the last joint is slightly emarginate at tip.

## GROUP VI.

In this group we have a species of oblong form, glabrous upper surface, and 10-jointed antennæ; the clypeus is slightly emarginate, the mandibles are but little prominent, the last joint of the maxillary palpi is distinctly oval, but has no lateral impression. The thorax is not narrowed at the base, and is hardly serrate on the sides: the upper spur of the posterior tibiæ of the male is fixed, laterally inserted and is oblique, thus causing the apical portion of the tibiæ to be emarginate beneath: the upper spur is flattened and acute: the claws are armed with a short acute tooth at the middle.

14. *L. congrua*, fusca, vel pallide castanea, oblonga, convexa, capite dense punctato, clypeo marginato, late sub-emarginato, thorace brevi sat confertim punctato, linea sæpe dorsali indistincto brevi, elytris rugose punctatis subcostatis, subtus pallide brunnea, vel testacea, pectore dense villosa, antennis flavis. Long. .65—.70.

New York, Georgia, and Texas. The pygidium is sparsely but strongly punctured. Only males are known to me, and in them the club of the antennæ is longer than the stem, the last three segments of the abdomen are broadly and deeply channeled, the penultimate has a deep posterior longitudinal line, and the last a triangular space limited each side by a sharply defined edge; the outline of the apex is sinuous, and has two small lobes at the middle. The inner posterior spur is straight, not shorter than the outer, but oblique and connate, inserted upon the side, so as to produce a deep inferior emargination.

## GROUP VII.

Contains a single oblong convex species, which, although glabrous above, is fringed on the margin with long erect hairs. The head is moderate, the clypeus narrowly margined, slightly emarginate; the antennæ are 10-jointed, the last joint of the maxillary palpi slender, not impressed. The thorax is not narrowed behind; the breast is clothed with long dense hair; the inner spur of the posterior tibiæ of the male is very long and irregularly bent, the outer one is equally long, but straight and slender; the tarsi are long, and the claws armed with a long tooth a little beyond the middle, so as almost to appear cleft.

15. *L. futilis*, oblonga convexa, pallide castanea nitida, capite dense punctato, sutura sublævi, clypeo anguste marginato, antice late emarginato, thorace sat dense punctato, lateribus serratis fimbriatis, elytris rugose punctatis vix obsolete costatis, margine longe fimbriato, pectore dense longe villosa. Long. .51—.67.

Lec. Agassiz' Lake Superior, 226.

Lake Superior, New York, Kansas; only males seen. Body oblong, convex; head densely punctured, with an indistinct smooth transverse line about the frontal suture; clypeus with narrow reflexed margin, slightly emarginate in front. Thorax one-half wider than the head, short, tolerably densely, not very coarsely punctured, sides

rounded, serrate and fimbriate, dorsal line smooth but not very distinct. Scutellum sparsely punctured. Elytra strongly rugous and punctured, with a faint trace of the inner dorsal costa, but no outer ones: margin fringed with long erect hairs. Pygidium convex, sparsely strongly punctured. Breast densely clothed with long yellow hair.

The male has the club of the antennæ longer than the stem, the abdomen longitudinally impressed, the penultimate segment with a faint transverse elevation, and the last segment with a large fovea bounded posteriorly each side by an acute edge extending to the apex; inner spur of the posterior tibiæ very long, slightly sigmoid, dilated into an oblique narrow disc at tip.

As frequently happens, when isolated species are described before the group to which they belong has been studied, the original description given by me makes no mention of the most remarkable characters of this species.

#### GROUP VIII.

This is the central group of the genus, and contains a large number of species, which seem in some cases to be so closely allied as to be undistinguishable, thus presenting the phenomenon of races, of which the examples are already so numerous in this as in every other department of Natural History. The body is glabrous above, and sometimes pruinose; the head is small, or moderate in size; the clypeus is more or less emarginate, though in *L. serricornis* it is entirely rounded. The thorax is usually gradually broader from tip to base, but sometimes its widest part is at the middle. The fifth ventral segment is broadly emarginate, and in the male is variously impressed, while the last of the same sex is widely but not deeply excavated. The unguis are variable in form, even between closely allied species. The inner spur of the posterior tibiæ of the male is straight and connate, while in the female both are free, and not very unequal.

According to the form of the clypeus and the sides of the thorax, the following division may facilitate the determination of the species:

\* Thorax not or hardly serrate, clypeus strongly margined . . . . . Sp. 16—21.

\*\* Thorax not or hardly serrate, clypeus finely margined, but more deeply emarginate Sp. 22—30.

Thorax angulated on the sides, strongly serrate, clypeus as in \*\* . . . . . Sp. 31—34.

16. *L. fusca*, fusco-picea, vel brunnea, subtus sæpe ferruginea, capite haud confluentur punctato, glaberrimo clypeo parum emarginato, thorace postice latiore, lateribus plus minusve rotundatis, subtilius punctato, elytris plus minusve punctatis et rugosis, subcostatis, pygidio parce punctato, pectore flavo-villoso, antennis pedibusque ferrugineis. Long. .78—.97.

*Melolontha fusca* Fröhlich, Naturf. 26, 99 (1792;) 29, 113, tab. 3, fig. 3.

*Melolontha quercina* Knoch, Neue Beytr. 74, tab. 1, fig. 27, (1801.)

*Melolontha fervens* Gyll. Schönh. Syn. Ins. App. 74.

*Melolontha fervida*† Oliv. Ins. 5, 24, tab. 9, fig. 109.

*Rhizotrogus fervens* Kirby, Fauna Bor. Am. 132.

*Lachnosterna quercina* Lec. Agass. Lake Sup. 226.

*Ancylonycha quercina* Burm. Lamell. 2, 2d, 319.

A very common and through Atlantic America widely extended species, embracing several races, to which, however, no definite characters can be given. The color varies according to the maturity of the specimen, but usually the whole under surface is ferruginous; the last ventral segment of the male has a broad round impression, and the penultimate is transversely impressed and elevated. The tooth of the claws of the tarsi in the male of the normal race is one-half shorter than the apical part; the club of the antennæ is as long as the stem. In the female the club is small, and the tooth of the claw is as long as the apical portion. The elytra are sometimes very finely rugous without punctures, sometimes very finely and sometimes quite distinctly punctured; the costæ are usually obvious. The sides of the thorax are sometimes slightly, sometimes very strongly rounded; the punctures are distinct but not large nor dense, sometimes a smooth dorsal line is left. The clypeus is usually distinctly, though slightly emarginate, but in some specimens the undulation is hardly perceptible.

The principal races are as follows:

α. Body nearly cylindrical, thorax much rounded on the sides; elytra finely and densely punctulate; male with long tooth on the ungues. *L. consimilis* Lec. Agassiz' Lake Sup. 226.

β. Body slightly ovate, thorax with the sides oblique and rounded, narrower than the elytra; male with unguis tooth short.

γ. Body ovate, thorax strongly punctured with the sides oblique and rounded, shorter than usual, narrower than the elytra, which are strongly punctured. *L. anxia* Lec. Agass. Lake Sup. 226. *A. brevicollis* Blanch. Cat. Col. Mus. Paris, 132.

δ. Thorax narrower than the elytra, almost angulated on the sides, finely sparsely punctured, elytra moderately punctured; claws of the male with long tooth. *A. brevicollis* Burm. Lamell. 2, 2d, 322.

ε. Body hardly ovate, thorax slightly narrower than the elytra, much rounded on the sides, elytra distinctly and sometimes strongly punctured; claws of male with a long tooth. *Ancylonycha puncticollis* Blanch. Cat. Col. Mus. Par. 133.

ζ. Larger, body subcylindrical, thorax very much rounded on the sides, elytra finely and densely rugulose and slightly punctulate. Male with a long tooth on the claws. *Rhizotrogus Drakii* Kirby, Fauna Bor. Am. 133.

*Ancyl. profunda* and *uniformis* Blanch. Cat. Col. Mus. Paris 132, 133, which are considered by Burmeister to be varieties of this species, appear by description so different that I am not warranted in so placing them, though the characters given are not such as to enable them to be distinctly recognized. The first mentioned is perhaps allied to *L. Knochii*.

A male specimen from Wisconsin, belonging by form and sculpture to γ, shows a remarkable sexual peculiarity in the penultimate abdominal segment, the elevation on which is very sharply defined and quite curved; in all the other males I have seen the elevation is straight, although sometimes very slightly emarginate.

17. *L. cephalica*, fusco-ferruginea, convexa, oblongo-ovata, nitida, capite haud confluentem punctato, utrinque parce breviter piloso, clypeo parum emarginato, thorace antrosum angustato fortius haud

dense punctato, lateribus modice rotundatis, elytris subcostatis fortius punctatis, pygidio parce punctato, pectore longe villosa, unguiculis dente mediocri armatis. Long. .69.

One specimen found at Fort Riley by Mr. de Vésey. This species has nearly the form of the common varieties of the preceding, but the punctures of the head, especially towards the side, support short erect hairs; the punctures of the thorax are stronger than usual in that species, and those of the elytra are not dense but strongly marked.

The antennæ are yellow, and the club of the male is a little longer than the stem; the abdomen is broadly impressed longitudinally, and the penultimate segment has an obtuse transverse elevation at the middle; the moveable spur of the posterior tibiæ is more slender than in *L. fusca*; the tooth of the claws is one-half the length of the apical portion.

18. *L. decidua*, fusco-ferruginea, convexa, oblongo-cylindrica, nitida, capite densius haud confluentem punctato, utrinque pube decidua erecta parce vestito, clypeo haud emarginato, thorace a medio antrorsum angustato, lateribus magis rotundatis longe fimbriatis subserratis, fortius haud dense punctato, elytris subcostatis densius punctatis, longe fimbriatis, pygidio parce punctato, pectore densissime villosa, unguiculis dente mediocri armatis. Long. .6—'65.

New York, Mr. Guex. This species and the preceding are nearly related, but the present is more cylindrical in form, with the thorax more rounded on the sides, fringed with long hairs, and narrowed only before the middle: the clypeus is also longer, not emarginate, and more closely punctured; and the elytra are finely and densely punctured. The hairs of the head are sometimes rubbed off, in which case the specimen assumes the appearance very nearly of *L. sororia*, but may be known by the long hairs of the sides of the thorax and elytra; the sexual characters are precisely as in the preceding.

19. *L. sororia*, elongata, subcylindrica, paulo ovata, fusco-castanea, obsolete pruinosa, capite antice dense postice parcius punctato, clypeo latius reflexo vix emarginato, thorace lateribus antice rotundatis parce fortius punctato, elytris fortius minus dense punctatis, subcostatis, pygidio parce punctato, pectore longe flavo-villosa, pedibus castaneis, unguiculis dente longo (♀) vel brevi (♂) armatis. Long. .63.

Middle and Southern States, rare: of somewhat the same form as *L. fraterna* and *L. cognata*, but more cylindrical, differing by the less emarginate but more strongly margined clypeus, and by the sparse punctuation of the head. Care must be taken not to confound it with a species (*L. rufiola*) having 9-jointed antennæ, which although resembling it entirely in form and sculpture, differs by the outer spur of the posterior tibiæ being less slender, and by the pygidium (of the female) being somewhat conoidal. Body above dark reddish brown, very slightly pruinose, cylindrical, a little dilated behind. Head moderately punctured, front densely punctured, clypeus with reflexed margin, very slightly emarginate. Thorax not twice as wide as the head, about twice as wide as long, sides not serrate, converging slightly from the base, but only broadly rounded, especially before the middle, surface equably but



sparsely and strongly punctured. Elytra sparsely and strongly punctured, with indistinct costæ. Pygidium triangular, with rounded angles, convex, sparsely punctured. Breast clothed with long yellowish hair; legs ferruginous.

The male has the club of the antennæ one-half longer than the stem: the abdomen broadly impressed from the base to the fifth joint, which has a very faint transverse impression; the last segment is convex in both sexes. The tooth of the claws is smaller in the male than the female.

20. *L. micans*, nigro-fusca, cinereo-pruinosa, oblongo-ovata, convexa, capite antice confluent, postice sat dense punctato, clypeo latius reflexo vix emarginato, thorace antrorsum angustato, fortiter haud dense punctato, elytris costatis fortius punctatis, pygidio sat punctato, pectore longe flavo-villoso, pedibus castaneis, unguiculis dente longo (♀) vel brevi (♂) armatis. Long. .65.

*Melolontha micans* Knoch, Neue Beytr. 77.

*Ancylonycha micans* Blanch. Cat. Col. Mus. Paris, 138; Burm. Lamell. 2, 2nd, 322.

Middle States, not rare. The club of the antennæ in the male is as long as the stem; the middle of the abdomen is broadly impressed for the whole length, and the penultimate segment has a slightly curved transverse elevation; the tooth of the claws is one-half as long as the apical portion, while in the female there is but little difference in length.

Mr. Blanchard places *A. micans* among the species having nine joints in the antennæ.

21. *L. serriornis*, supra testaceo-rufa, subtus fusca, oblongo-ovata, convexa, nitida, capite thoraceque obscurioribus, illo dense punctato, clypeo integro tenue marginato, thorace lateribus rotundatis ciliatis, minus dense punctato, elytris fortius punctatis subcostatis, pectore longe villosa, unguiculis dente elongato armatis, antennis articulis 3—7 sensim latioribus. Long. .60.

One female found at Coney Island, near New York. Body oblong slightly ovate, convex; head dark reddish brown, densely punctured, clypeus rounded finely margined; thorax a little paler than the head and one-half wider than it, convex, rounded on the sides, which are sparsely ciliate, strongly but not densely punctured. Elytra paler yellowish brown, more coarsely punctured than the head and thorax, convex, with the sutural costa narrow, and the others slightly visible. Propygidium finely punctured, and pubescent at the upper half, then glabrous and more sparsely but coarsely punctured: pygidium strongly punctured, rounded. Beneath fuscous, pectus clothed with long yellow hair; abdomen pubescent and punctured at the sides; penultimate segment with a coarsely punctured vague transverse impression; last segment coarsely punctured, convex, bisinuate at tip.

22. *L. semicribrata*, elongata, testaceo-ferruginea, nitida, capite dense punctato, clypeo emarginato, tenue marginato, thorace lateribus rotundatis ante basin latiore, disco parce grosse punctato, spatio lævi utrinque relicto, elytris rugose punctatis vix costatis, pectore breviter parce villosa, unguiculis dente (♀) magno armatis. Long. .58.

One female from Georgia? Nearly of the form of a *Cyclocephala*, but presenting all

the characters of the present genus. Body uniform shining brownish red; head flat, densely punctured in front, convex and less densely on the vertex, with the occiput smooth; clypeus finely margined, moderately emarginate; antennæ pale, 10-jointed. Thorax about one-half wider than the head, nearly twice as wide as long, much rounded on the sides, narrowed in front, and somewhat narrowed towards the base; moderately convex, with large scattered punctures along the sides, margins and middle, leaving a space each side in front free from punctures. Elytra hardly wider than the thorax, rugosely punctured in front, sparsely punctured behind, with the sutural ridge very strong, but the dorsal ones obsolete. Pygidium very sparsely punctulate. Breast clothed with very short hair. Abdomen convex, smooth in the middle, punctured at the sides, especially the penultimate segment: the latter impressed transversely at the middle towards the posterior margin. Tibiæ not at all hairy; spurs of posterior tibiæ equal, slender; unguis armed with a long tooth.

23. *L. lugubris*, tota nigro-picea, nitida, subovata convexa, clypeo emarginato, capite antice confertim postice convexo et parce punctato, thorace lateribus rotundatis, ante basin sublato, parce fortiter punctato spatio transverso antico lævi, elytris subtiliter punctatis vix obsolete costatis, pygidio parce punctulato, pectore breviter villosa, unguiculis (♀) dente longo armatis. Long. .62.

Two females from New York. More ovate and less slender than the preceding, entirely of a blackish brown, almost black above and shining. Head flat and densely punctured in front, convex and sparsely punctured behind, clypeus finely margined, emarginate; thorax twice as wide as the head, fully twice as wide as long, rounded on the sides, slightly narrowed at the base, sparsely and coarsely punctured, with a transverse smooth space before the middle. Elytra a little wider than the thorax, finely punctured; each puncture supports a very minute hair; the sutural costa is very strong, and there are some faint traces of the dorsal ones. Propygidium nearly smooth, pygidium finely sparsely punctulate. Breast with short not dense yellowish hair. Abdomen convex, smooth in the middle, finely punctured at the sides, but more coarsely on the two last segments, penultimate joint margined behind at the middle.

24. *L. cognata*, supra fusca, vel nigro-fusca, subtus ferruginea nitida, oblonga, clypeo emarginato, capite dense punctato, thorace lateribus rotundatis, postice perparum angustato, fortius subæqualiter punctato, elytris punctatis rugosis subcostatis, pygidio parce punctato, pectore flavo-viloso, unguiculis dente longo armatis. Longo. .60—72.

? *Ancylonycha cognata* Burm. Lamell. 2, 2d, 323.

Common in the Middle and Southern States. The only satisfactory difference I find between this and the next species is in the form of the thorax, which is here much more rounded on the sides, and slightly narrowed at the base. The other differences noted by Burmeister, such as the greater concavity of the clypeus, the longer hair of the pectus, and the finer punctures of the pygidium I do not find constant; but fearing not to possess his species I have placed a query to the reference.

The punctures of the thorax are variable, being sometimes strong and scattered, at others finer and more numerous, but there is never any distinct smooth dorsal line. The punctures of the elytra support very small hairs; the sides of the abdomen are punctured, more distinctly on the last two segments; in the male the last one is foveate, and the penultimate impressed in the middle, and the anterior segments are slightly flattened; the club of the antennæ is not longer than the stem.

25. *L. fraterna*, nigro-fusca, vel piceo-nigra, oblonga nitida, pedibus castaneis, capite dense punctato, clypeo anguste marginato, emarginato, thorace antrorsum angustato, lateribus obliquis late rotundatis, fortius inæqualiter punctato, linea dorsali lævi, elytris punctatis rugosis, subcostatis, pygidio parce punctato, pectore griseo-villoso, unguiculis dente longo armatis. Long. .60—.70.

*Phyllophaga fraterna* Harris, Ins. Injurious to Vegetation, 1st ed. 29; 2d, 28.

*Ancylonycha fraterna* Blanch. Cat. Col. Mus. Paris, 133 (syn. excl.); Burm. Lamell. 2, 2d, 322.

Middle, Eastern and Southern States, abundant, as far west as Kansas. The sexual characters are precisely as in the preceding, except that the penultimate ventral segment is more deeply impressed; the punctures of the elytra also support very small hairs. I have not observed any well marked races in the species, though individual differences occur in the size and closeness of the punctures of the thorax.

26. *L. lutescens*, rufo-testacea, oblongo-ovata convexa nitida, capite obscuriore confertim punctato, clypeo emarginato, thorace fortiter parce punctato, rufescente, antrorsum angustato, lateribus magis rotundatis, elytris subtilius punctatis subcostatis, pygidio vix punctulato, pectore longo flavo-villoso, unguiculis dente longo armatis. Long. .59.

One male from Georgia. Related by sculpture to the two preceding, but apart from color, it differs by the head being not confluent punctured, and by the thorax being more convex. The club of the antennæ of the male is as long as the stem; the penultimate ventral segment is impressed with a slight oblique elevation each side of the impression, the last segment is deeply foveate, and the anterior ones longitudinally impressed, the last two segments are punctured, but the pygidium is only very finely punctured, and the propygidium is smooth.

27. *L. corrosa*, castanea, oblonga, antice angustior, capite nigricante, dense confluent punctato, clypeo tenue marginato, emarginato, thorace rude sat dense punctato, linea dorsali sublævi, lateribus serratis parce fimbriatis, elytris subtilius punctatis, vix costatis, pectore brevius flavo-villoso, tibiis posticis calcaribus elongatis, unguiculis dente acuto longo armatis. Long. .77.

Texas; two males collected by Mr. A. Schott, of the U. S. and Mexican Boundary Survey. Body oblong, narrower in front, shining reddish brown. Head dark piceous, very densely, confluent punctured, clypeus emarginate, with a narrow reflexed margin. Thorax about one-half wider than the head, scarcely one-half wider than long, obliquely narrowed in front, and very slightly so behind; sides serrate, sparsely fimbriate; covered with large punctures, sometimes confluent, with an indistinct smooth dorsal line. Elytra more finely punctured, with faint traces of dorsal costæ;

propygidium finely, pygidium strongly sparsely punctured. Breast clothed with rather short yellow hair.

Male with the club of the antennæ a little shorter than the stem; the abdomen slightly flattened in the middle, the penultimate segment with an obtuse rough transverse elevation near the tip, the last segment with a triangular excavation deeper at the apex; spurs of the posterior tibiæ long, slender, acute and nearly equal, the inner one fixed, and a little shorter.

28. *L. calceata*, obscure castanea, antice angustior, capite dense confluent punctato, clypeo tenue marginato, emarginato, thorace rude subconfluent punctato, linea dorsali lævi, lateribus vix serratis parce fimbriatis, elytris rugose punctatis, subcostatis, pectore flavo-villoso, antennis læte flavis, tibiis posticis (maris) calcare interno lato brevi, unguiculis dente acuto armatis. Long. .75.

One male, Texas, Mr. H. Haldeman. Remarkable for the characters of the posterior tibiæ and tarsi, though otherwise allied to the preceding. Body oblong, slightly narrowed in front, dark reddish brown. Head very densely punctured, clypeus emarginate, with the margin narrowly reflexed. Thorax more than one-half wider than the head, short, coarsely and subconfluent punctured, with various small spaces smooth; punctures smaller and more dense towards the apex, which is broadly foveate each side; dorsal line smooth entire; sides hardly serrate, obtusely angulated, slightly fimbriate. Scutellum with two groups of punctures. Elytra not shining, rugosely punctured, with moderately distinct costæ, margin slightly fringed; pygidium sparsely punctured, slightly flattened at the middle. Breast clothed with rather short but dense yellow hair. Abdomen punctured; claws armed with an acute moderate sized tooth at the middle.

The male has the club of the antennæ as long as the stem; the abdomen broadly concave, the penultimate with a deep posterior medial line, and two rough transverse elevations near the anterior margin; the last segment is very broadly excavated; the inner spur of the posterior tibiæ is very short, broad, flat, obtuse and concave, the outer one is long, flattened, and somewhat acute; the first joint of the posterior tarsi is very much thickened and produced externally.

From the peculiar sexual characters I am inclined to believe that this should be separated as a group, but not knowing the female, I cannot indicate any distinctive characters applicable to both sexes.

29. *L. marginalis*, oblongo-ovata, convexa, testaceo-rufa vel fusco-picea, nitida, pedibus castaneis capite densissime punctato, clypeo tenuiter marginato, emarginato, thorace punctis magnis vagis inæqualiter sitis, spatio lævi utrinque relicto, elytris rugosis punctatis, costa submarginali fere integra, pygidio fortiter punctato, pectore flavo-villoso, unguiculis dente magno armatis. Long. .70—.80.

New York. Nearly of the same form as *L. fraterna*, but differing by many characters. The color is entirely bright reddish-brown, or else blackish-brown with the legs and antennæ red: the head is sculptured as in *L. fraterna*: thorax not twice as wide as the head, twice as wide as long, narrowed from the base, rounded on the sides,

sparsely covered with large punctures so placed as leave a large smooth space each side of the middle. Elytra gradually widened behind, rugose and punctured, with the usual faint costæ, and a strongly marked submarginal one, extending nearly to the base. Propygidium sparsely, towards the tip strongly punctured; pygidium strongly punctured; abdomen punctured, more faintly in the middle; pectus clothed with moderately long yellow hair.

The male has the club of the antennæ longer than the stem; the abdomen flattened in the middle; the penultimate segment with a semicircular curved elevation, and middle fovea, and the last segment with a longitudinal broad furrow. The abdomen of the female is almost uniformly punctured, the punctures of the last two segments being stronger; the pygidium is triangular, and slightly conical at tip, while in the male it is broader and convex.

This species is remarkable for the length of the submarginal elytral costa, which in most species is seen only near the apex.

30. *L. obesa*, ovata, convexa, castanea nitida, capite dense punctato, clypeo haud confluentur punctato, reflexo, late emarginato, thorace sat dense punctato, lateribus valde rotundatis, elytris fortius punctatis, subcostatis, pectore flavo-villoso, antennis flavis, unguiculis dente mediocri armatis. Long. .72.

Texas, Mr. H. Haldeman. Shorter and more ovate in form than the others of this group. Head densely, clypeus less densely punctured, the latter moderately margined, in front broadly emarginate. Thorax nearly twice as wide as the head, short, convex, tolerably densely, but almost finely punctured; sides very much rounded, serrate, slightly fimbriate. Scutellum sparsely punctured, middle smooth. Elytra dilated behind, strongly punctured, with very faint traces of dorsal costæ, pygidium sparsely punctured. Breast clothed with yellowish hair. Abdomen punctured at the sides; claws with an acute tooth just within the middle.

Male with the club of the antennæ as long as the stem; the abdomen broadly flattened at the middle, with the anal fovea broad, extending from the last upon the penultimate segment, which has a slight curved transverse elevation; posterior tibiæ with the inner spur one-half shorter than the outer, fixed, straight; pygidium transverse, slightly convex.

Female with the spurs of the posterior tibiæ nearly equal, flattened, but not broad; pygidium triangular, obtusely protuberant near the tip.

31. *L. prunina*, atro-purpurea, oblongo-ovata convexa, capite densissime punctato, clypeo anguste marginato, emarginato, thorace lateribus serratis subangulatis, postice vix angustato, sat dense fortiter punctato, elytris pruinosis, parce punctatis, subcostatis, pygidio nitido fortiter punctato, pectore parum piloso, unguiculis dente longo armatis. Long. .70.

*Ancylonycha pruinosa*|| Mels. Proc. Acad. Nat. Sc. Philad. 2, 140.

One specimen from Cleveland, Ohio, Dr. Kirtland; found in Alabama according to Melsheimer. Resembles in appearance *L. micans*, but differs very greatly in its

characters. The thorax is shining, and the punctures are equally distributed; the sides are somewhat serrate, and behind the middle are nearly parallel; the pygidium is coarsely punctured, the propygidium is nearly smooth, with a few punctures as usual at the margin. The abdomen (of the female) is convex, punctured and pubescent at the sides, more deeply on the last two segments; the last one has a triangular flattened impression at the middle; the pectus is thinly clothed with fine short yellowish hair; the tibiæ are dark brown, and the tarsi paler. Burmeister, not having seen this species, places it as identical with *L. micans*.

32. *L. rugosa*, ferrugineo-fusca (vel fusco-nigra) oblonga, convexa nitida, capite densissime punctato, clypeo tenue marginato, emarginato, thorace lateribus fere angulatis, postice subangustato, confertim sat fortiter punctato, linea dorsali lævi, elytris punctatis rugosis subcostatis, pygidio parce punctato, pectore breviter villosa, unguiculis dente longo armatis. Long. 80—85.

*Ancylonycha rugosa* Mels. Proc. Acad. Nat. Sc. 2, 140; Burm. Lamell. 2, 2nd, 328.

Two specimens from Platte River. According to the authors quoted, it is found in Virginia and Pennsylvania. The propygidium is finely and sparsely punctured; the sides of the abdomen are finely punctured, with the punctures larger on the penultimate segment.

In the male the club of the antennæ is as long as the stem; the abdomen is flattened in the middle; the penultimate segment has a deep transverse impression, and each side of it an oblique elevation; the last segment has a broad reniform impression, and the pygidium is broad and obtusely rounded.

In the female the abdomen is convex, the last segment is sparsely punctured, and deeply squarely emarginate; the penultimate segment has a posterior deep transverse impression; and the pygidium is triangular.

33. *L. affinis*, fusco-ferruginea, oblonga, convexa, nitida, capite thoraceque obscurioribus, illo confertissime punctato, clypeo tenue marginato, emarginato, thorace grosse punctato, linea dorsali lævi, lateribus fortiter serratis angulatis, postice subangustato, elytris punctulatis vix costatis, pygidio parce punctato, pectore breviter villosa, unguiculis dente magno armatis. Long. 73.

One male, upper Missouri, Dr. F. V. Hayden. Closely related to the preceding, but the thorax is shorter, more narrowed in front, and strongly serrate on the sides: the elytra are smoother, not rugose, with finer punctures.

The club of the antennæ is shorter than the stem; the last segment of the abdomen is broadly foveate and the penultimate segment is broadly impressed, with a straight transverse obtuse elevation.

34. *L. Knochii*, fusco-ferruginea, capite thoraceque obscurioribus, illo densissime punctato, clypeo tenuiter marginato, emarginato, thorace rude confluentem punctato, lateribus angulatis fortiter serratis, postice angustato, elytris confertim punctato-rugosis vix costatis, pygidio punctato, pectore breviter pubescente, unguiculis dente magno armatis. Long. 90.

*Melolontha Knochii* Gyll. Schönh. Syn. Ins. App. 75.

*Ancylonycha Knochii* Blanch. Cat. Col. Mus. Paris, 133; Burm. Lamell. 2, 2d, 325.

Middle and Southern States, rare. The pygidium of the female is subtriangular but not conoidal; the punctures are more sparse towards the apex; the sides of the abdomen are punctured, and the penultimate segment has a strongly transverse impression at the middle. The male is unknown to me, but the penultimate ventral segment is described by Burmeister as having no transverse elevation, but a deep impression.

## GROUP IX.

The group contains a number of large oblong species having the upper surface pubescent. The head is moderate in size, with the clypeus emarginate, not broadly margined; the thorax is broadest at the middle, and more or less narrowed towards the base. The antennæ are 10-jointed; the breast is clothed with hair. The unguis are toothed at the middle, but the tooth is as long as the apical portion, so that the form appears almost cleft. The spurs of the posterior tibiæ are straight, and the inner one is fixed in the male; the penultimate ventral segment of the male is transversely impressed, while the last joint is broadly foveate.

35. *L. ilicis*, glauco-fusca, subpruinosa, supra pube brevi subdepressa cinerea vestita, thorace confluentè grosse punctato, medio subcarinato, elytris dense rugulosis et punctulatis, costis dorsalibus nullis, margine longe fimbriato, pectore breviter villosa. Long. .88—1.0.

*Melolontha ilicis* Knoch, Neue Beytr. 75, tab. 1, fig. 28.

*Melolontha porcina* Hentz, Trans. Am. Phil. Soc. 3, 253, tab. 2, fig. 4.

*Ancylonycha ilicis* Blanch. Cat. Col. Mus. Paris, 1, 133; (nec. Burm. Lamell. 2, 2d, 326.)

*Ancylonycha fimbriata* Burm. ibid.

Common in the Middle and Southern States; according to the maturity of the specimen the color varies from blackish fuscous to reddish brown, but the glaucous lustre is always distinct in well preserved specimens, and the legs are ferruginous. In the male the club of the antennæ is as long as the remaining portion; the hair above is finer and less dense, but the hair on the breast is a little longer than in the female; the penultimate ventral segment is deeply transversely impressed, and the last joint marked with a broad round impression.

The present species agrees with the figure and description of Knoch, and is also found as the type in Dr. Melsheimer's collection. That described by Burmeister is something different, and has not yet fallen under my notice: it differs by the finer and more depressed pubescence; by the hair on the breast being scarcely longer (even in the male) than that on the abdomen, and by the pygidium being coarsely punctured with a smooth middle space; in the present species the punctures are scattered, gradually less numerous towards the tip.

36. *L. ciliata*, fusca, (abdominis lateribus solis pruinosa), pube suberecta fulva brevi dense vestita, thorace confluentè grosse punctato, subcarinato, elytris dense rugulosis et punctulatis, subcostatis, pilis longioribus intermixtis præcipue in vittis tribus positis, margine longe fimbriato, pectore breviter piloso. Long. 1.0.



One female from Georgia and another Missouri. Of the same size, form and sculpture as the preceding, but differing not only by the color of the pubescence, but by its texture; the hair is short erect and brownish yellow; it is uniform on the thorax, but on the elytra many longer hairs are intermixed, which on looking obliquely backwards, are seen to be arranged chiefly in three vittæ, although there are some scattered ones especially externally: the margin is fringed as in the preceding with long hair. The sides of the abdomen under the elytra are slightly pruinose; the punctures of the pygidium are larger and more distant than in *L. ilicis*. The legs are ferruginous.

37. *L. subtonsa*, fusca, supra pube brevi suberecta fulva æqualiter vestita, thorace confluentem dense punctato subcarinato, elytris dense rugulosis vix obsolete costatis; pectore longius villosus. Long. .82.

One male found at New York, and kindly given me by Mr. Guex. This species has the form and sculpture of the preceding, but the pubescence is entirely uniform, and the margin of the elytra is not fringed with long hair. The pygidium is moderately coarsely punctured, with the punctures more distant at the middle. The legs are dark brown: the hair on the breast is moderately long, and the sexual characters are precisely as in *L. ilicis*.

38. *L. hirticula*, fusco-ferruginea, pilis erectis longis flavis, in elytris vittatim positæ parce vestita, thorace cribratim punctato, elytris rugose punctatis haud costatis, pectore longe villosus. Long. .65—.75.

*Melolontha hirticula* Knoch, Neue Beytr. 79.

*Melolontha hirsuta*† Say, Journ. Acad. Nat. Sc. Phil. 3, 243.

*Phyllophaga hirticula* Harris, Ins. Inj. Veget. 2d ed. 28.

*Melolontha hirticula* Burm. Lamell. 2, 2d, 327.

Very abundant in the Atlantic States. The hairs on the elytra form a vitta near the suture, three discoidal ones, and a marginal fringe. The pygidium is glabrous and sparsely punctured. The club of the antennæ of the male is as long as the stem, the middle of the abdomen is flattened, and the inner posterior spur is fixed.

#### GROUP X.

This group contains species having the characters of those of the two last, except that the antennæ have only nine joints (the seventh being obliterated;) the third, fourth and fifth are equal in length, and connate; the sixth is slightly produced internally. The tooth of the unguis varies according to the species.

One species is sparsely pilose, others have a few hairs on the front, while the rest are glabrous: the thorax is never narrowed at the base.

39. *L. hirsuta*, piceo-ferruginea, oblonga nitida, capite confertim punctato, clypeo marginato, emarginato, thorace fortius minus dense, elytris rugose punctatis, pilis longis flavis erectis minus dense vestita, pygidio fortius punctato, piloso; pectore longe villosus, unguiculis dente longo armatis. Long. .67—.72.

*Melolontha hirsuta* Knoch, Neue Beytr. 78.

*Ancylonycha hirsuta* Blanch. Cat. Col. Mus. Paris (syn. excl.) 138.

Middle and Southern States. The pygidium is sparsely punctured; the legs and antennæ are bright ferruginous; the club of the antennæ of the male is a little longer than the stem; the middle of the abdomen of the male is broadly depressed, the last joint is marked with a broad shallow fovea, and the penultimate has a transverse obtuse elevation; in the female the last mentioned joint is strongly transversely impressed at the middle, and has anterior to the impression a small elevation.

40. *L. balia*, elongata, cylindrica, fusca nitida, elytris castaneis densius punctatis haud costatis, capite confertim punctato, hirtio, clypeo marginato late emarginato, thorace disperse inæqualiter punctato, lateribus rotundatis, pygidio fortius punctato, pectore longe villosio, unguiculis dente longo armatis. Long. .66.

*Melolontha balia* Say, Journ. Acad. Nat. Sc. 5, 191.

*Ancylonycha comata* Burm. Lamell. 2, 2d, 337.

One male from New York, Mr. Guex. This species has nearly the form, sculpture and sexual characters of the preceding, but there are no hairs on the upper surface except between the eyes. From the next species it differs by its more cylindrical form, more sparsely punctured thorax, and by the more strongly margined and less emarginate clypeus.

41. *L. vilifrons*, castanea, capite thoraceque obscurioribus, illo confertim punctato, pilis erectis hirtio, clypeo emarginato, tenue marginato, thorace parum convexo, antrorsum angustato, lateribus obtuse subangulatis, sat punctato, elytris minus convexis subtilius confertim punctatis haud costatis, pectore longe flavo-villosio, unguiculis dente longo armatis. Long. .60.

One male found at Lake Superior. Body oblong, less convex than usual, reddish brown, darker on the head and thorax. Head strongly and closely punctured, with erect yellowish hairs proceeding from the punctures; clypeus finely margined, and deeply emarginate. Thorax nearly twice as wide as the head, less than twice as wide as its length, obtusely angulated at the middle of the sides, narrowed in front, but not behind, strongly but not densely punctured, with the sides partly ciliate, and towards the base slightly serrate. Scutellum with two groups of punctures. Elytra finely and closely punctured, slightly rugous, with the sutural ridge narrow, and the others (even the submarginal,) entirely wanting; propygidium and pygidium punctured. Abdomen shining, sparsely punctured, breast clothed with long yellow hair. Male with the club of the antennæ one third longer than the stem; penultimate ventral segment slightly impressed, and rugous at the middle; last segment with a channel in the middle of the broad impression.

42. *L. hirticeps*, testaceo-rufa, subovata convexa, capite thoraceque obscurioribus, illo fortiter densius punctato parce hirtio, fronte foveata, clypeo emarginato tenue marginato, thorace convexo, lateribus rotundatis subrepandis parce ciliatis, inæqualiter fortiter parcius punctato, elytris fortius punctatis, costa suturali angusta, reliquis nullis, pygidio (feminæ) conico, pectore modice villosio, unguiculis dente elongato armatis. Long. .92.

One female, Georgia. Allied by characters to *L. villifrons*, but the form is more convex, the punctures of the thorax are more distant, and those of the elytra less fine. Body oblong ovate convex, bright yellowish brown inclining to reddish, darker on the head and thorax. Head strongly and thickly punctured, sparsely pilose, with a slight fovea at the middle of the front; clypeus emarginate finely margined. Thorax one-half wider than the head, convex, rounded on the sides, which are almost entire and but sparsely ciliate; disc covered unequally with tolerably large sparse punctures, leaving an indistinct smooth anterior space each side. Elytra slightly dilated behind, convex, tolerably strongly punctured, with the sutural costa narrow elevated, and the others completely wanting. Propygidium distinctly, not densely punctured; pygidium conical, with scattered large punctures, slightly prominent and nearly smooth at tip. Abdomen sparsely punctured at the sides and tip; penultimate segment with a transverse short plica and impression at the middle; last segment hardly emarginate. Pectus clothed with moderately long yellow hair; claws with the tooth as long as the apical portion.

43. *L. nitida*, fusca, oblonga, convexa, pernitida, pedibus antennisque castaneis, capite fortiter punctato, canaliculato, clypeo densius punctato, marginato, emarginato, thorace lateribus rotundatis parce subtilius punctato (fovea utrinque versus latera impresso), elytris minus dense punctatis, subcostatis, pygidio parce punctato (feminae conico,) pectore longe villosa, unguiculis dente longo armatis. Long. 82.

One female from Georgia. Of the size and proportions of *L. fusca* but more oblong and convex, dark brown, very shining. Head strongly punctured, with a medial abbreviated furrow; clypeus densely punctured, emarginate, with the margin reflexed. Thorax nearly twice as wide as the head, more than twice as wide as long, regularly rounded on the sides, which are sparsely ciliate, but not at all serrate; disc finely and distantly punctured, (with a fovea, perhaps accidental, towards each side.) Scutellum entirely smooth. Elytra not densely but distinctly punctured, with the sutural ridge narrow, and the other ridges visible, though not much elevated. Propygidium and pygidium sparsely punctured, the latter conical and protuberant towards the tip. Abdomen sparsely punctured at the sides and tip, penultimate segment with a faint transverse impression at the middle. Breast somewhat densely clothed with yellowish hair. Antennæ and legs bright castaneous; claws with a tooth as long as the apical portion.

44. *L. rufiola*, castaneo-rufa, oblonga convexa, nitida, capite fortiter minus dense punctato, clypeo emarginato, reflexo, thorace lateribus rotundatis integris parce ciliatis, fortiter parce punctato, elytris fortius punctatis, subcostatis, costa laterali evidentiore, pectore parce breviter villosa, unguiculis dente longulo armatis. Long. 63.

One female, Georgia. Body oblong, convex, pale reddish brown. Head strongly but not densely punctured, punctures more close in front; clypeus reflexed, slightly but distinctly emarginate. Thorax hardly one half wider than the head, short; sides rounded not serrate, sparsely ciliate; disc convex, deeply but not very coarsely punc-

tured, punctures somewhat sparse. Elytra tolerably strongly punctured, slightly rugous, with the sutural costa narrow and elevated; the discoidal ones may be traced, and the submarginal one is very distinct, and somewhat elevated behind the middle. Pygidium of the female conical, not very prominent at tip, smooth, with a few large punctures at base. Pectus clothed thinly with short hair. Abdomen sparsely strongly punctured at the sides and apex; penultimate segment slightly impressed transversely each side; last segment deeply emarginate and ciliate at tip.

Care must be taken not to confound this species with *L. glaberrima* above described; the female of the latter has almost precisely the same form, color and sculpture, it is however not so convex; the punctures of the clypeus are as distant as those of the head, and the pygidium is closely punctured and not conical; the antennæ are 10-jointed, though by the consolidation of the articulations this fact is to be recognized by there being two nodiform joints next the club; and finally the last point of the maxillary palpi are externally impressed.

45. *L. robusta*, oblonga, convexa, castaneo-rufa, obsolete pruinosa, capite densius punctato, clypeo marginato, vix obsolete emarginato, thorace sat dense punctato, linea media lævi, lateribus serratis, elytris fortiter sat dense punctatis subcostatis, pygidio (feminæ) conico, pectore dense villosa, unguiculis dente longo armatis. Long. .92.

One female, from Kansas near the Rocky Mountains. More robust than the other species of this division, but hardly ovate, convex, brownish red; head and breast darker. Head strongly and densely punctured, with the clypeus margined, but scarcely emarginate. Thorax scarcely one-half wider than the head, short, less densely punctured than the head, with a smooth dorsal line not reaching the apex, sides rounded in front, somewhat serrate, sparsely ciliate. Elytra more coarsely punctured than the thorax, slightly rugous, very slightly pruinose, sutural costa broad, and the others slightly marked. Propygidium naked, punctured; pygidium conical, shining, sparsely but coarsely punctured, apex protuberant, subtruncate. Abdomen paler than the upper surface, punctured at the sides and tip; last segment flattened in the middle and broadly emarginate at tip; penultimate not impressed. Breast densely pilose; ungues with a long tooth.

#### GROUP XI.

A group containing a single glabrous species having the antennæ 9-jointed, with the joints of the stem short and serrate, the third fourth and fifth as usual consolidated, but with distinct inner angles. The clypeus is rounded and broadly reflexed. The last joint of the maxillary palpi is cylindrical, the mandibles are only slightly prominent. The sixth joint of the abdomen is shorter than in the first groups, though not so short as in the following ones. The spur of the posterior tibiæ of the male is fixed; the tooth of the claws is medial and short; the pectus is only very thinly clothed with hair.

46. *L. i n t e g r a*, cylindrico-oblonga, rufo-testacea, nitida, capite sat dense, clypeo fere parcius punctato, rotundato, reflexo, thorace fortiter minus dense punctato, lateribus rotundatis, elytris rugosis fortius punctatis subcostatis, pygidio parce punctato, ad apicem subtruncato, pectore parce villosa, unguiculis dente parvo armatis. Long. .65.

One male, Georgia. Body cylindrical oblong, almost uniform rufo-testaceous, shining. Head strongly punctured, a little less densely on the clypeus, which is rounded and strongly reflexed. Thorax about twice as wide as the head, rounded on the sides, strongly but not densely punctured. Elytra coarsely and moderately densely punctured, with the sutural costa narrow, and the others limited by indistinct striae. Propygidium very finely and sparsely punctulate; pygidium sparsely strongly punctured, convex, triangular, subtruncate at tip. Breast thinly clothed with short hair; abdomen sparsely punctured at the sides. Ungues with a small tooth at the middle, tibiae not hairy.

The club of the antennae of the male is a little shorter than the stem; the abdomen is broadly impressed for its whole length; the last segment is slightly elevated in front each side, and has behind at the middle some transverse elevated punctures: the spurs of the posterior tibiae are slender, and the inner one is fixed and one half shorter.

#### GROUP XII.

This group contains species having the upper surface hairy; the antennae 10-jointed, the clypeus distinctly margined, but slightly or not at all emarginate, and the last ventral segment very short; the sexual characters are very feebly marked; there are no differences in the tibiae, and but very slight ones in the abdomen and antennae.

47. *L. c r e n u l a t a*, fusca, confertim fere aequaliter punctata, thorace linea dorsali fere nulla, lateribus fortius serratis, longe pubescente, elytris pube breviora dense vestitis pilis longioribus intermixtis, obsolete costatis, pectore longe villosa, unguiculis dente magno armatis. Long. .63—.8.

*Melolontha crenulata* Fröhlich, Naturf. 26, 94; 29, 111, tab. 3, fig. 2.

*Melolontha georgicana* Gyllenhal, Schonh. Syn. Ins. Append. 77.

*Phyllophaga georgicana* Harris, Ins. Injurious to Vegetation, 2nd ed. 28.

*Ancylonycha crenulata* Blanch. Cat. Col. Mus. Paris, 133, (synon. exclusa); Burm. Lamell. 2, 2d, 327.

Massachusetts, Georgia, Kansas: the specimens from the last mentioned locality are smaller, but do not otherwise differ. The pygidium is densely punctured.

48. *L. a l b i n a*, fusca dense fere aequaliter punctata, dense albido-pubescent, thorace pilis longioribus intermixtis, linea dorsali scutelloque alboribus, pectore longius villosa, elytris costatis, unguiculis dente magno armatis. Long. .7.

*Ancylonycha albina* Burm. Lamell. 2, 2d, 328.

One female found at Natchez, Mississippi; Dr. Schaum. This species has nearly the form of the preceding, but the sculpture is finer, and the pubescence is much more dense; on the elytra long hairs are intermixed only at the base and sides, while the general pubescence of the thorax is similar to that of the elytra, with numerous long erect hairs intermixed.

49. *L. parvidens*, ferrugineo-fusca, subpruinosa, æqualiter punctata, pube flava erecta in thorace et ad elytrorum basin longiore vestita, pectore longe villosa, unguiculis dente brevi armatis. Long. .77.

One male from Georgia. Closely allied to the preceding; the thorax is finely punctured, convex, slightly narrowed towards the base. The elytra are finely punctured, with the sutural ridge well defined, not wider than usual; the dorsal costæ are very faint: the margin is not fringed, and long hairs are seen only towards the base. The club of the antennæ is as long as the stem, and the abdomen is not impressed. The posterior and middle tarsi are imperfect, but the anterior ones are armed only with a short acute tooth.

50. *L. rubiginosa*, ferrugineo-fusca, subpruinosa, thorace longe minus dense villosa, brevi, subtilius punctato, postice haud angustato, elytris subtilius punctatis, breviter pubescentibus, pilis longis parvis versus basin intermixtis, margine fimbriato, pectore longe villosa. Long. .65—.76.

Texas, at New Braunfels, collected by Mr. Lindheimer. Body oblong, slightly ovate, convex; above of a brownish red, with a grayish lustre on the elytra. Head densely, thorax finely punctured, clothed not very densely with long soft erect yellow hair; the thorax is short, and is not narrower at the base than at the middle. The elytra are finely punctured, not costate, but with the sutural ridge broader and less elevated than in the others; the surface is thinly clothed with short yellowish hair, with longer hairs intermixed especially towards the base; the margin is fringed: the pygidium is moderately punctured: the breast is covered with tolerably long dense hair.

In the male the club of the antennæ is as long as the stem and the abdomen has a scarcely perceptible anal impression: the spurs of the posterior tibiæ are free in both sexes.

*α.* In one male specimen of a more cylindrical form there is a bifurcating oblique elevated line each side of the penultimate ventral segment, but in the other specimens I cannot perceive any vestige of such ornament. Subsequent collections may show the propriety of regarding it as a separate species, for the sutural ridge is more strongly marked, and somewhat narrower. I would hesitate at present to give it as distinct, as no other difference in sculpture can be perceived.

### GROUP XIII.

Consists of pruinose species, glabrous above, having 10-jointed antennæ, and not emarginate penultimate ventral segment. The head is comparatively large and the clypeus is strongly margined, hardly sinuate in front. The mandibles project strongly; the last joint of the maxillary palpi is slightly oval, not impressed. The thorax is rounded on the sides, not narrowed at the base. The breast is tolerably densely clothed with long hairs; the tarsi are long and the ungues are toothed near the base.

In the males the club of the antennæ is nearly as long as the stem; the penultimate

ventral segment is transversely protuberant, and rough with elevated punctures, while the last segment is slightly impressed transversely. The spurs of the posterior tibiæ are free in both sexes.

51. *L. submucida*, oblonga convexa, subcylindrica, picco-rufa, pruinosa, capite dense punctato, clypeo reflexo submarginato, thorace confertim haud fortiter punctato, elytris fortius punctatis, brevissime pubescentibus, costa submarginali distincta, pectore flavo-villoso, unguiculis breviter dentatis. Long. .72—.75.

Found by Mr. Arthur Schott, of the U. S. and Mexican Boundary Commission, on the journey from Laredo to Ringgold Barracks. Body oblong cylindrical, convex, uniform reddish, with a pruinose lustre. Head large, closely punctured, clypeus scarcely sinuate in front, but strongly margined. Thorax more than one-third wider than the head, finely and closely punctured, sides rounded subserrate, sparsely ciliate. Elytra more strongly punctured, with very short procumbent hairs in each puncture, sutural costa broad, submarginal one distinct. Pygidium sparsely punctured, shining. Abdomen punctured at the sides.

52. *L. glabricula*, oblonga, convexa, testaceo-rufa, subpruinosa, capite dense punctato, clypeo reflexo haud emarginato, thorace confertim subtilius punctato, elytris fortius punctatis, glaberrimis, costa submarginali obsoleta, pectore flavo-villoso, unguiculis breviter dentatis. Long. .64.

Kansas, near the Rocky Mountains. Agrees with the preceding in sculpture, but is smaller and somewhat more robust, the surface is less pruinose, the punctures of the elytra support hairs so much smaller that they are hardly visible, and the submarginal costa can hardly be seen. The sexual characters are precisely as in the preceding.

More full series may show the propriety of regarding this as a race of the preceding species, but at present it seems sufficiently distinct to entitle it to a separate name.

#### GROUP XIV.

I have placed in this group a single species having the appearance of those of the next group, but differing by the more robust form, and by the mandibles being visible at the tip. The head is small and hairy, the clypeus deeply concave and rounded; the last joint of the maxillary palpi is hardly oval, and not impressed; the mandibles are visible and tolerably prominent. The antennæ are 10-jointed. The thorax is hairy and not narrowed at the base. The last ventral segment is very short, as in the two preceding groups, and the penultimate of the male is not impressed. The claws are armed with a small tooth at the middle.

53. *L. glabripennis*, oblonga, minus convexa, æqualiter fortiter punctata, clypeo rotundato, concavo, thorace brevi, lateribus subangulatis, elytris haud costatis glabris, capite thorace scutelloque saturatioribus longe pubescentibus, pectore longissime villosa, pygidio parce punctato et pubescente. Long. .53.

One male collected on the Rio Grande by Mr. A. Schott of the United States and



Mexican Boundary survey. The club of the antennæ is nearly twice as long as the stem; the abdomen is without impression; the spurs of the posterior tibiæ are free, long, flattened and obtuse.

## GROUP XV. (D).

Contains some of the smallest species of the genus; they are of an oblong elongate form, with the upper surface, at least of the thorax and base of the elytra, pilose with long hairs. The head is small, the clypeus concave, broadly margined, and rounded. The tips of the mandibles are not visible in a state of repose; the last joint of the maxillary palpi is slightly oval and has an impression on the outer face. The thorax is slightly narrowed at the base. The last segment of the abdomen is short, though not so very short as in the groups XII, XIII, and XIV. The spurs of the posterior tibiæ of both sexes are free, long flattened and obtuse, though slender. On account of the small size of the mandibles the first species of the group was considered as a distinct genus *Trichesthes* by Erichson, but Lacordaire, considering it as established upon insufficient grounds, has properly as I think, suppressed it. Burmeister retains it in his work on *Lamellicornia*, but with an addition of species which renders it unrecognizable.

54. *L. tristis*, testacea, elongato-oblonga, capite thoraceque saturatioribus, dense grosse punctatis, longe pilosis, clypeo integro concavo, thorace postice subangustato elytris confertim punctatis, haud costatis, breviter pilosis, pilis longis versus basin raris intermixtis, margine longe fimbriato, pectore longe dense villosa. Long. .47—.56.

*Melolontha tristis* Fabr. Syst. El. 2, 168.

*Melolontha pilosicollis* Knoch, Neue Beytr. 85, tab. 3, fig. 29. Say, Jour. Acad. Nat. Sc. Phil. 3, 243. Harris, Ins. Mass. Inj. Veg. 2nd ed. 28.

*Trichesthes pilosicollis* Er. Ins. Deutchl. 3, 658.

*Trichestes tristis* Blanch. Cat. Col. Mus. Paris, 141: Burm. Lamell. 2nd, 358.

Middle and Southern States, abundant. In the male the club of the antennæ is longer than the stem, the middle of the abdomen is broadly concave, the penultimate segment has an acute transverse crest at the middle, and the margins of the last segment are slightly elevated.

55. *L. crinita*, elongata, testacea, fortiter punctata, clypeo concavo rotundato, capite thoraceque rufescentibus, hoc postice angustato, longe villosis, elytris breviter pubescentibus, pilis longis paucis versus basin intermixtis, margine fimbriato; pectore longe dense villosa. Long. .5.

? *Trichestes crinita* Burm. Lamell. 2, 2nd, 358.

Texas, Mr. H. Haldeman. This species agrees with the preceding in sculpture and appearance, but the body is longer, cylindrical in the male, slightly ovate in the female; the thorax is more narrowed behind, and the hairs of the elytra are shorter: the latter character is noticed by Burmeister but the former is omitted. The sexual characters are precisely the same.

*Unknown or unrecognized species.*

- Ancylonycha profunda* Blanch. Cat. Col. Mus. Paris, 132. Texas  
*Ancylonycha crassissima* Blanch. ibid. 133. Texas.  
*Ancylonycha longicornis* Blanch. ibid. 134.  
*Ancylonycha diffinis* Blanch. ibid. 138. Texas.  
*Ancylonycha ilicis*† Burm. Lamell. 2, 2nd, 326.  
*Ancylonycha gibbosa* Burm. Lamell. 2, 2nd, 324.  
*Ancylonycha Forsteri* Burm. ibid. 325.  
*Trichestes comans* Burm. ibid. 358.  
*Trichestes prununculina* Burm. ibid. 360.  
*Trichestes gracilis* Burm. ibid. 361.

## GYNNIS Lec. ○

In this genus I have placed a single small elongate species, differing from species of Group IV of *Lachnosterna* by the obliquity of the inner posterior spur of the male and by the impression of the last joint of the maxillary palpi. The head is moderate in size, with strong frontal suture, the clypeus is deep, rounded and strongly margined: the antennæ are 9-jointed, with the third and fourth joints longer than the following: the last joint of the maxillary palpi is oval and has a slight lateral impression externally: the mandibles are moderately prominent, the labrum is very short and broad, directed backwards and very slightly concave, not by any means bilobed as in the other genera of *Rhizotrogi* known to me. The ligula is almost truncate in front, and the mentum is broadly concave; the last joint of the labial palpi is oval. The legs are slender, the middle tibiæ with two, the posterior tibiæ with one transverse crest of spines: the tarsi are elongate, and the claws are hardly perceptibly toothed near the middle. The inner spur of the posterior tibiæ of the male is fixed, and slightly oblique, so as to form an inferior emargination, the outer one is free, slender and acute. The last ventral segment of the abdomen is moderately large, slightly impressed.

1. *G. debilis*, testacea, elongata, nitida, capite fusco sat punctato, clypeo rotundato, concavo testaceo thorace lateribus rotundatis postice subangustato, sat fortiter punctato, elytris fortius punctatis haud costatis, costa suturali elevata subrugosa, pectore fortiter punctato, parum pubescente. Long. .43.

One specimen found at Philadelphia was given me by Mr. Schafhirt.

The club of the antennæ of the male is longer than the stem; the abdomen is longitudinally slightly impressed, and the last joint is faintly but broadly foveate, and the fovea does not attain the anterior margin; the tibiæ are described above.

## LISTROCHELUS Blanchard.

Corpus oblongum, subcylindricum alatum, supra subglabrum, elytris glauco-pruinosis. Clypeus rotundatus marginatus; labrum profunde emarginatum; mandibulæ parum prominulæ. Mentum paulo concavum,

ligula truncata; palpi maxillares articulo ultimo modice ovali, impresso. Antennæ 10-articulatæ, articulis 3—5 connatis, 3 et 4 æqualibus; clava triarticulata, maris elongata, feminæ parva. Elytra stria suturali profunda. Abdomen articulis 1—5 connatis, suturis haud medio oblitteratis, 6to brevi transverso. Coxæ posticæ angulo externo productæ. Tibiæ anticæ tridentatæ, posteriores uni-coronatæ, denteque parum prominulo superiore præcipue armatæ, bicalcaratæ, calcaribus posticis sexus utriusque mobilibus, exteriori longiore: tarsi tibiis longiores, verticillatim setosi, postici articulo primo paulo breviori, nonnunquam tibiis haud longiores; unguiculi (maris præcipue) subtus sulcati, biserialim pectinati, vel compressi, medio dentati, subtus plus minusve uniserialim serrulati.

By the discovery of new species I have been compelled to modify the description of this genus, until at last nothing distinct remains to separate it from *Lachnosterna*. In one species the serration of the unguis disappears almost entirely, only a slight trace near the base being left. There is however a peculiar appearance which renders the genus easy of recognition, and notwithstanding the remarkable specific and sexual characters, would make any further subdivision of the species here placed under it eminently unnatural.

#### A. Tibiæ posticæ sub-bicoronatæ.

1. *L. mucoreus*, longior, convexus, piceo-rufus, capite thoraceque nitidis, illo plano fortiter marginato, confertim punctato, antice rotundato haud emarginato, thorace punctato, lateribus obtuse angulatis, antice subserratis, angulis posticis obtusis haud rotundatis; elytris parce punctatis et breviter pilosis, glauco-pruinosis; supra versus latera parce longe pilosus, pectore villosus, calcare postico externo latiore et longiore, tarsi posticis tibiis multo longioribus. Long. .6—·65.

Maris antennarum clava funiculo vix breviori; pygidio convexo, unguibus subtus biserialim fortius pectinatis; antico exteriori prope apicem fere dentato.

Feminæ unguibus subtus prope apicem acute dentatis, a basi ad dentem pectinatis, postico interiore pectinato haud dentato; pygidio plano.

Fort Yuma, Colorado River, California; Eagle Pass, Texas, Mr. Schott. The outer spur of the posterior tibiæ is longer and broader than the inner one, both are flattened and obtuse. The hairs towards the base of the elytra are very long.

2. *L. texanus*, longiusculus, oblongus, convexus, piceo-rufus, capite thoraceque nitidis, illo plano fortiter marginato, confertim punctato, antice rotundato submarginato, thorace minus dense punctato, lateribus fortius angulatis subserratis, angulis posticis obtusis haud rotundatis, ad basin longe erecte fimbriato, elytris parce punctatis et breviter pilosis, glauco-pruinosis; supra versus latera parce longe pilosus, pectore villosus; calcare externo postico fere duplo latiore et longiore, tarsi posticis tibiis longioribus. Long. .5.

Mas notis sexus sicut in præcedente.

One specimen found in Texas by Mr. Schott. Closely related to *L. mucoreus*, but is a little less elongated, with the sides of the thorax more strongly angulated, and subconcave in outline behind the angle, and with a basal fringe of long erect hairs. the inner spur of the posterior tibiæ is only two-thirds as long as the outer one, and is more slender than in the preceding species.

3. *L. obtusus*, piceo-ferrugineus, oblongus, convexus, capite rotundato fortiter marginato, confertim punctato, thoraceque nitidis, hoc sat dense punctato, lateribus rotundatis medio subangulatis, angulis posticis obtusis rotundatis, marginibus et ad basin longe piloso, elytris glauco-pruinosis vage punctatis, versus basin longe pilosis ad marginem parce pilosis; pectore villosa; calcare externo postico fere duplo latiore et longiore, tarsis posticis tibiis vix longioribus. Long. .55.

Mas notis sexus sicut in præcedentibus.

One specimen found by me in Kansas, near Platte River. More robust and less cylindrical than the preceding species, with the sides of the thorax less angulated. Some of the hairs about the base of the thorax arise from the disc, and the hairs near the base of the elytra are longer than in the other species, and the punctures behind the middle are almost without hairs. The spurs of the posterior tibiæ are as in the preceding.

B. Tibiæ posticæ unicoloratæ: tarsi postici tibiis haud longiores.

4. *L. falsus*, convexus ferrugineus, capite rotundato, antice vix sinuato marginato, fortiter punctato parce piloso, thorace punctato, lateribus serratis obtuse angulatis, angulis posticis obtusis subrotundatis, elytris glauco-pruinosis, obsolete tricotatis, parcius punctatis, parce pilosis; lateribus et thoracis basi longe parce setosus, pectore villosa, calcaribus posticis angustis externo longiore. Long. .54—.59.

Mas cylindricus elongatus, clava antennarum funiculo longiore; pygidio magis convexo, abdomine late concavo, articulis 5to et 6to medio canaliculatis; unguiculis dente medio minuto armatis vix obsolete serratis, interno anteriore edentato.

Femina subovata; pygidio paulo convexo, abdomine tumido, medio polito; unguiculis omnibus medio dente parvo acuto armatis, obsolete serratis.

Platte River, Kansas. This species, though having all the external appearance of the others, by its characters approaches so near to *Lachnosterna* as to suggest a doubt whether the two genera should properly remain distinct.

5. *L. fimbripes*, subovata, convexa, ferruginea, capite rotundato, antice subsinuato, marginato, fortiter punctato, parce piloso, thorace punctato, lateribus obtuse angulatis, angulis posticis obtusis rotundatis, elytris subpruinosis parce punctatis vix breviter pilosis; lateribus et thoracis basi parce longe setosus, pectore villosa, tibiis tarsisque posticis intus longe laxè pilosis calcaribus posticis angustis. Long. .48.

Mas antennarum clava funiculo fere longiore; abdomine medio fere plano, segmentis 5 et 6 leviter canaliculatis; unguiculis obsolete serratis minime dentatis.

One specimen, Fort Riley, Kansas, Dr. W. A. Hammond, U. S. A. Somewhat more robust than the preceding species.

6. *L. scoparius*, elongatus, cylindricus, piceo-rufus, capite rotundato fortiter marginato, antice vix sinuato, fortiter punctato, thorace punctato, lateribus subserratis angulatis, angulis posticis obtusis haud rotundatis, elytris parce punctatis et pilosis, glauco-pruinosis: marginibus longe parce pilosis, pectore dense villosa, tibiis posticis intus longe, tarsis posticis subtus densissime villosis; calcaribus posticis angustis. Long. .61.

Mas antennarum clava funiculo haud longiore; propygidio fere nudo, pygidio maiore valde convexo; abdominis segmento 6to subtus producto et acute longe bidentato; unguiculis fortius pectinatis.

Sonora, near the Boundary line, Mr. Arthur Schott. From the curious characters of the abdomen and posterior tarsi, I was strongly tempted to consider this as a

separate genus, but the preceding species is intermediate in the last mentioned peculiarity, and the former is altogether a sexual mark. The sixth ventral segment is large, and projects downwards; it is smooth and flat on its anterior surface, strongly punctured and hairy on the posterior surface, which is convex, and nearly horizontal; the line where the two surfaces meet is armed at the middle with two large sharp teeth.

#### 4. DILOTAXES.

This group established by Kirby, but first defined as a sub-group by Lacordaire, contains species of small size, forming the transition from the groups with transverse not prominent anterior costæ, to those with the coxæ conical. The thorax is almost always furnished with an apical membranous margin, a character not known to me in any other group except *Dichelonychæ*, which differ by the chelate ungues. Burmeister's group of *Schizonychæ* should probably enter here, as they differ only by the greater depth of the emargination of the labrum, and the less breadth of the ligula: the former is indeed not free from variation in our species of *Diplotaxis*. It has not escaped the attentive eye of Lacordaire that the ventral sutures are distinct in this group, not effaced at the middle as in *Rhizotrogi*; but he mentions that exceptions in this respect are found in *Empecta*: as that genus has no apical margin of membrane on the thorax, I am in doubt whether it might not be more naturally placed in *Rhizotrogi*.

A character not noted by previous authors, which seems to distinguish this group, is the entire coalescence, without perceptible suture between the 5th ventral segment and the propygidium; I know of no other group in which this takes place, and taken in conjunction with the small pygidium, the disappearance of the sixth ventral segment, the distinctness of the ventral sutures, and the prominence of the anterior coxæ, it would seem to render this as distinctly limited as the other groups here recognized.

Our genera may be thus distinguished:—

Ungues antici dente parum prominulo apicali, posteriores fissi	-	-	-	<i>Orsonyx</i> Lec.
Ungues omnes conformes:				
Palpi maxillares articulo ultimo ovali	-	-	-	<i>Diplotaxis</i> Kirby
Palpi maxillares articulo ultimo elongato, cylindrico	-	-	-	<i>Alobus</i> Lec.

#### ORSONYX Lec.

Corpus oblongum, paulo convexum, alatum; clypeus margine reflexo, late rotundatus medio subsinuatus, sutura frontali distincta. Labrum concavum, modice emarginatum; mandibulæ validæ prominulæ; maxillæ mala exteriore ad apicem bidentata; (palpi desunt). Mentum trapezoideum, ligulæ latæ connatum, antice se micirculariter depressum; palpi labiales laterales; antennæ breves 10-articulatæ, clava parva triphylla. Thorax ad apicem membranula coriacea marginatus, linea marginali nulla. Tibiæ anticæ tridentatæ unicalcaratæ, posteriores extus bicoronatæ, ad apicem paulo incrassatæ, posticæ intus dense pilosæ; tarsi tibiis vix longiores, setosi; unguiculis anticis dente tenui acuto subapicali parum prominulo armatis, posterioribus fissis, parte inferiore latiore acuto subtruncato vix brevior: propygidium fere omnino tectum.

*O. anxius*, oblongus paulo convexus, ater subnitidus, capite dense punctato, vertice vage bifoveato, clypeo rotundato, marginato, antice submarginato, sutura frontali utrinque profundiore, thorace dense punctato, subcanaliculato, lateribus rotundatis ante medium angustato, angulis posticis obtusis subrotundatis, elytris punctatis, subtricotatis, costis uniseriatim punctatis, pygidio grosse punctato, propygidio antice subtiliter postice grosse punctato. Long. .41.

One specimen found by Thos. H. Webb, M. D. of the U. S. and Mexican Boundary Commission in the valley of the Gila. The under surface is coarsely punctured, and it as well as the pygidium is sparsely hairy.

#### DIPLOTAXIS Kirby.

The species in this genus are now quite numerous, and in sculpture, color and form resemble each other in many instances very closely; I have, therefore sought to establish natural divisions by which they may be classified into small groups. The following will serve the purpose.

A. *GENUINÆ*. Ungues omnes fissi; (h. e. dente ungue parum brevior); spiracula postica haud prominula; thorax linea apicali nulla.

a. Thorax ad angulos plus minusve impressus, angulis anticis præcipue acuminatis.

Caput haud carinatum, corpus pubescens . . . . .	I. Sp. 1.
Caput haud carinatum, corpus supra glabrum . . . . .	II. Sp. 2—5.
Caput carinatum, corpus supra glabrum . . . . .	III. Sp. 6—7.

b. Thorax ad angulos haud impressus; caput haud carinatum.

Clypeus hemihexagonus, angulis acutis elevatis . . . . .	IV. Sp. 8.
Clypeus varius, angulis rotundatis vel nullis . . . . .	V. Sp. 9—24.

B. *SPURILÆ*. Spiracula postica prominula.

Ungues fissi . . . . .	Sp. 25.
Ungues medio dentati . . . . .	Sp. 26.

C. *SPURILÆ*. Ungues medio dentati; spiracula postica haud prominula.

Thorax linea apicali nulla . . . . .	Sp. 27.
Thorax ad apicem marginatus . . . . .	Sp. 28—29.

#### I.

1. *D. sordida*, nigra, opaca, undique pube erecta brevi fulva vestita, thorace densius pubescente, elytris subtilius, thorace capiteque rugose densissime punctatis, hoc hemihexagono, margine reflexo, antice late emarginato, sutura frontali profunda, utrinque excavata, tibiis anticis subtridentatis. Long. .47.

*Melolontha sordida* Say, Journ. Acad. Nat. Sc. 5, 197.

*Diplotaxis carbonaria* Burm. Lamell. 2, 2nd. 262.

Pennsylvania and Georgia; rare. The thorax is transversely broadly sulcate near the base and apex; the basal angles are not at all rounded, the sides are subangulated behind the middle, and the anterior angles are subacuminate. Burmeister describes the elytra as being costate; in one specimen they are so, in another there are faint traces of external striæ, and of the three discoidal flattened costæ. The teeth of the anterior tibiæ are equidistant, the upper one is feeble.

## II.

2. *D. subcostata*, fusco-ferruginea, nitida, oblonga, convexa, capite hemihexagono, grosse punctato, margine reflexo, antice vix emarginato, thorace parcius punctato, lateribus medio valde rotundatis, angulis omnibus acutis vage impressis, elytris grossius punctatis, tricostatis, tibiis anticis subtridentatis; sutura frontali profunda utrinque exaraba, vertice late convexo. Long. 39—45.

Blanch. Cat. Col. Mus. Paris, 171.

Georgia; not rare. Varies a little in the outline of the thorax, and in the depth of the punctures; it is however always obtusely rounded at the middle, sinuate before and behind, with acute angles.

3. *D. liberta*, nigro-picea nitida, oblonga, convexa, capite hemihexagono, tenuiter marginato, fortiter punctato, antice haud emarginato, thorace fortiter haud dense punctato, parcius in medio, lateribus medio rotundatis, angulis anticis subacuminatis, posticis obtusis haud rotundatis, omnibus paulo impressis, elytris fortius punctatis, concinne tricostatis, tibiis anticis tridentatis, sutura frontali profunda, vertice planiusculo. Long. 45—5.

Burm. Lamell. 2, 2nd, 261.

*Melolontha liberta* Germ. Ins. Nov. 123.

Middle and Southern States; *D. tristis* Kirby, placed by Burmeister as synonymous with this species, is quite distinct, having a thickly punctured thorax, of a different form.

4. *D. brevicollis*, oblonga, convexa, piceo-ferruginea nitida, capite punctato, hemihexagono, antice late emarginato, margine anguste reflexo, sutura frontali profunda, thorace brevi subtilius punctato, lateribus oblique rotundatis, angulis anticis subacutis posticis fere rectis, omnibus impressis; elytris subtilius punctatis et tricostatis, tibiis anticis obtuse tridentatis. Long. 47.

One specimen collected by George Gibbs, Esq., at Steilacoom, Washington Territory.

5. *D. tristis*, oblonga, minus convexa, nigra subnitida, capite dense punctato hemihexagono, antice subemarginato, margine anguste reflexo, sutura frontali profunda, thorace lateribus oblique rotundatis, angulis anticis subacutis, posticis obtusis, omnibus paulo impressis, elytris punctatis, tricostatis, tibiis anticis obtuse tridentatis. Long. 43—53.

Kirby, Fauna Bor. Am. 130.

Middle States and Lake Superior, not rare.

## III.

6. *D. excavata*, oblonga, nigro-picea, nitida, capite vix hemihexagono, margine reflexo antice fere rotundato, grosse, occipite parcius punctato, sutura frontali profunde excavata, fronte transversim carinata, medio subimpressa, thorace grosse punctato, antice posticeque versus latera transversim excavato, lateribus medio rotundatis angulis anticis subacuminatis, elytris rude punctatis, subcostatis, tibiis anticis subtridentatis. Long. 35.

One specimen, Georgia. The punctures of the elytra are large, and sometimes confluent, they are mostly arranged in rows, except towards the suture, and the three costæ are not much more evident than the other intervals.



7. *D. frontalis*, oblonga, nigro-picea, nitida, capite fere rotundato, margine reflexo, grosse occipite parce punctato, sutura frontali profundo, fronte transversim carinata medio subimpressa, thorace parcius punctato, lateribus medio rotundatis, angulis anticis acutis, haud acuminatis, elytris rude punctatis subcostatis, tibiis anticis subtridentatis. Long. .35.

Georgia. Of the same appearance as the last, from which it only differs by the thorax being hardly perceptibly impressed at the angles, instead of being deeply excavated. Perhaps this may be a sexual character.

*D. punctatorugosa* Blanch. having the front transversely elevated, must belong to this group. Blanchard, however, describes it as "breviter ovata," while according to Burmeister, who does not mention the form, the anterior tibiæ are acutely 3-toothed.

#### IV.

8. *D. angularis*, elongata cylindrica, ferruginea nitida, capite punctato, hemihexagono, margine reflexo, ad apicem late emarginato, angulis acutis prominulis, sutura frontali mediocri, vertice late convexo, thorace modice punctato, antrorsum angustato, lateribus pone medium fortius rotundatis angulis obtusis, elytris punctatis, tricostatis, tibiis anticis tridentatis. Long. .3.

Copper Mines of the Gila, Dr. Webb. The female is slightly ovate. The apical reflexed margin of the clypeus makes with the lateral margin a reentering angle.

#### V.

9. *D. moerens*, oblonga, minus convexa, picea vel nigro-picea subnitida, capite conflenter punctato, plano, hemihexagono, tenuiter marginato, antice late emarginato, sutura frontali parum impressa, thorace confertim punctato, lateribus rotundatis, angulis posticis obtusis, elytris fortiter punctatis, punctis fere omnibus seriatis, vix tricostatis, tibiis anticis tridentatis. Long. .44.

Vallecitas, California. Of the size, form and color of *D. tristis*; the inferior portion of the claws is rather shorter than usual, and the labrum is deeply emarginate.

10. *D. punctipennis*, oblonga, convexa, ferrugineo-picea nitida, capite fortiter punctato, clypeo rotundato, latius marginato, sutura frontali impressa, thorace sat dense fortius punctato, lateribus valde rotundatis angulis posticis obtusis, elytris grosse punctatis, punctis fere omnibus seriatis, vix tricostatis, tibiis anticis fortiter tridentatis. Long. .44.

Texas, Mr. Haldeman. The spaces which represent the usual costæ, and the suture are marked with a row of smaller punctures. The inferior part of the unguis is shorter than the upper, but not so much so as in *D. moerens*.

11. *D. texana*, oblonga, convexa, fusco-ferruginea nitida, capite dense punctato, clypeo rotundato, anguste marginato, sutura frontali impressa, thorace fere dense punctato, lateribus modice rotundatis, angulis posticis obtusis, elytris punctatis tricostatis, tibiis anticis tridentatis. Long. .38.

New Braunfels, Texas, Mr. Lindheimer. The punctures between the costæ are confused; the costæ are marked with a row of smaller punctures; the teeth of the anterior tibiæ are not large, and are more close than usual. The clypeus in one specimen is semicircular, but in the other is feebly hemihexagonal. The under part of the unguis is hardly shorter than the upper.

12. *D. Harperi*, ferrugineo-picea, oblonga paulo convexa, nitida, capite fortius confertim punctato, clypeo anguste marginato, rotundato, sutura frontali impressa, thorace fortius sat dense, medio minus dense punctato, antrorsum subangustato, lateribus latius rotundatis, angulis posticis obtusis, elytris fortiter punctatis, subtricastis, costis fortius uniseriatim punctatis, tibiis anticis obtuse tridentatis. Long. .37.

? Blanch. Cat. Col. Mus. Hist. Nat. Paris, 171.

Burm. Lamell. 2, 2d, 263.

Fort Riley, Kansas, Dr. Wm. A. Hammond; found according to Blanchard in Georgia, and Burmeister in S. Carolina. Differs from the next two species by the less rounded sides of the thorax, and the more narrowly margined clypeus; the latter is rounded in the arc of a circle. The punctures of the costæ of the elytra are somewhat irregular; the teeth of the anterior tibiæ are obtuse, and the two lower ones are nearer.

13. *D. frondicola*, oblonga convexa, fusco-ferruginea, nitida, [capite dense punctato, clypeo vix hemihexagono, anguste marginato, sutura frontali impressa, thorace dense punctato, lateribus rotundatis, angulis posticis obtusis, elytris punctatis, tricastis, tibiis anticis dentibus tribus magis approximatis. Long. .28—.32.

*D. testacea* Burm. Lamell. 2, 2d, 263.

*Melolontha frondicola* Say, Journ. Acad. 5, 198.

A common species from New York to Texas, and Kansas. The head is always slightly hemihexagonal; the under part of the claws is not shorter than the upper portion. The punctures between the costæ are confused, and the costæ are marked with a row of smaller punctures.

The species described by Mr. Blanchard as Say's is something quite different.

14. *D. dubia*, oblonga, convexa, fusco-ferruginea, nitida, capite dense punctato, clypeo rotundato, marginato, sutura frontali impressa, thorace dense punctato, lateribus rotundatis, angulis posticis obtusis, elytris fortiter punctatis, tricastis, tibiis anticis bidentatis. Long. .32.

Texas, two specimens, Mr. Haldeman. So similar to the preceding, that it might readily be confounded with it. On comparison, however, several differences may be found: the thorax is not so short, and the posterior angles are less obtuse; the clypeus is rounded in an arc of a circle, and more strongly margined; the upper tooth of the anterior tibiæ is almost entirely obliterated.

15. *D. truncatula*, oblongo-ovata, convexa, picea, capite confertim punctato, hemihexagono, clypeo tenuiter marginato, antice truncato, sutura frontali profunda, thorace sat dense punctato, lateribus oblique æqualiter rotundatis, angulis posticis obtusis rotundatis, elytris grossius punctatis, tricastis, tibiis anticis tridentatis. Long. .32.

One specimen, Kansas. The costæ of the elytra are without punctures, or with only a very few small ones. The upper tooth of the anterior tibiæ is acute and distant from the others.

16. *D. consors*, oblonga, nigro-picea, convexa nitida, capite confertim punctato, hemihexagono, clypeo tenuiter marginato, antice truncato, sutura frontali profunda, thorace minus dense punctato, lateribus rotundatis, angulis posticis obtusis rotundatis, elytris grossius punctatis tricastis, tibiis anticis tridentatis. Long. .3.

One specimen, Texas, Mr. Haldeman. Very similar to *D. truncatula*, but differs by the thorax being not so much narrowed in front, less rounded about the posterior angles and less densely punctured. The feet are brownish, the anterior tibiæ as in *D. truncatula*.

17. *D. carbonata*, oblonga, atra subnitida, capite dense punctato, clypeo vix hemihexagono, tenuiter marginato, thorace minus dense punctato, lateribus valde rotundatis, angulis posticis obtusis rotundatis, elytris punctis fortibus fere omnibus seriatis, subtricastis, tibiis anticis tridentatis. Long. .27—.3.

New Mexico and Texas, Messrs. Clark and Webb. The punctures except near the sutural line are hardly confused, the interstices are marked with ranges of small punctures; the upper tooth of the anterior tibiæ is obtuse but obvious.

18. *D. atratula*, oblonga, atra subnitida, capite dense punctato, clypeo hemihexagono, antice late emarginato, modice marginato, thorace fortius punctato, lateribus antice obliquis parum rotundatis ad angulos posticos fortius rotundatis, elytris punctis fortibus fere omnibus seriatis, vix tricastis, tibiis anticis fortiter tridentatis. Long. .3.

Frontera, New Mexico, Mr. Clark. Of the form size and color of *D. carbonata*, but differing in the sides of the thorax being oblique and hardly rounded, except near the posterior angles; the punctures of the elytra are not confused near the sutural line, and the interstices are not punctured. The legs as usual are brown, and the upper tooth of the anterior tibiæ is strong and acute.

19. *D. m o r u l a*, elongato-oblonga, atra subnitida, capite confertim punctato, clypeo hemihexagono, anguste marginato antice truncato, sutura frontali profunda, thorace sat dense punctato, lateribus antice obliquis postice cum angulis rotundatis, elytris fortius punctatis, tricastis, tibiis anticis fortius tridentatis. Long. .3.

One specimen, Kansas. Narrower than the preceding species, from which it also differs, not only by the posterior angles of the thorax less suddenly rounded, but by the punctures between the geminate rows being confused; the costæ themselves are marked with a few small punctures. The legs are brown, and the upper tooth of the anterior tibiæ is strongly marked.

20. *D. punctata*, nigro-picea, oblonga, convexa, nitida, capite confertim punctato, marginato, hemihexagono, antice late truncato, sutura frontali impressa, thorace fortiter minus dense punctato, lateribus antice obliquis, pone medium valde rotundatis fere angulatis, angulis posticis perobtusis, elytris fortius punctatis, subcostatis, tibiis anticis fortius tridentatis. Long. .32.

One specimen, Frontera, Rio Grande, Mr. Clark. The punctures of the two inner interstices of the elytra are confused, but the costæ are not very distinct; the costæ are marked with a row of fine punctures.

21. *D. cribulosa*, oblonga, subovata, ferruginea nitida, parce fulvo-pubescent, capite fortius dense punctato, marginato, hemihexagono, antice late truncato, sutura frontali impressa, thorace fortiter minus parce punctato, lateribus rotundatis, antice obliquis, angulis posticis obtusis, elytris fortiter punctatis, subcostatis, tibiis anticis subtridentatis. Long. .34.

One specimen found with the preceding. This species is by its sculpture related to *D. punctata*, but the thorax is more coarsely punctured, and the costæ of the elytra are marked with a very strong row of punctures, which with the punctures between the geminate rows are furnished with short but stout suberect hairs: the punctures of the thorax and those near the frontal suture also emit hairs. The labrum is more deeply emarginate than in the other species, but the under part of the claws is as long as the upper, the thorax has a narrow apical membrane, and all the other characters are of this genus.

22. *D. subangulata*, oblonga, convexa, nigro-picea nitida, capite dense punctato, marginato, fere hemihexagono, antice late truncato, thorace haud dense punctato, lateribus rotundatis medio subangulatis angulis posticis valde obtusis, elytris fortiter seriatim punctatis, punctis internis solis confusis, costis parum distinctis subtiliter uniseriatim punctatis, tibiis anticis acute tridentatis. Long. .34.

One specimen, Oregon, Col. McCall. The under part of the claw is a little shorter than the upper, and less obviously truncate than usual.

23. *D. bidentata*, ovata, convexa, nigro-picea, vix ænescens nitida, capite parcius fortiter punctato, clypeo rotundato, marginato, sutura frontali impressa, thorace parce fortiter punctato, lateribus oblique late rotundatis, angulis posticis obtusis, elytris fortius punctatis, tricostatis, tibiis anticis bidentatis. Long. .3.

Georgia, two specimens. Differs from all others known to me by the ovate body, the sparsely punctured head, and bidentate tibiæ. The punctures between the suture and the first dorsal costæ are confused, those between the other two costæ and the first are less so, but still somewhat confused. The punctures of the under surface are larger and more abundant than usual: the propygidium is more prominent than in the other species and is marked near the apex with a tolerably strong transverse raised line.

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The following species cannot be referred to its proper division, from the loss of the head.

24. *D. tenuis*, elongata, cylindrica testacea, thorace confertim punctato, antice posticeque angustato, lateribus rotundatis medio fere angulatis, elytris seriatim punctatis, punctisque paucis internis confusis, tricostatis, tibiis anticis obtuse subdentatis. Long. .28.

A dead specimen found at Vallecitas, San Diego County, California. Resembles in its proportions *D. angularis*, and probably belongs to Div. IV., but differs greatly in the sculpture of the elytra; the punctures of the first interstice are confused, those of the other intervals between the costæ, are represented by rows of punctures equal in size to those of the regular rows but more distant; the costæ are without punctures. The terminal tooth of the anterior tibiæ as usual is long, the others are almost obsolete: the lower part of the unguis is acute, and hardly shorter than the upper; the posterior tibiæ have more long hairs than in *D. angularis*.

B. *Spuriæ*.

25. *D. corvina*, oblongo-ovalis, convexa, piceo-nigra nitida, capite confertissime punctato, clypeo marginato, rotundato, sutura frontali impressa, thorace latitudine plus duplo brevior, fortius sat dense punctato, lateribus rotundatis, parcius ciliatis, angulis posticis obtusis rotundatis, elytris seriatim punctatis, vix tricostratis, punctis internis solis confusis, antennis palpisque piceo-rufis, unguibus fassis. Long. .44.

One specimen, Fort Yuma, Colorado River, California. This insect has the appearance of a large *Aphodius*. The spaces of the elytra which represent the costæ are marked each with a row of small punctures. The under surface is very coarsely punctured, and the punctures have short yellowish hairs. The pygidium is very coarsely and the propygidium densely punctured, the latter is transversely elevated, or rather broadly sulcate near the apex. The posterior tibiæ at the outer apical angle are armed with three longer spines.

26. *D. pacata*, oblongo-ovata convexa, ferrugineo-picea, nitida, capite confertim punctato, clypeo subrotundato, marginato, sutura frontali impressa, vertice vage bifoventato, thorace sat dense punctato, antrosum angustato, lateribus postice cum angulis valde rotundatis, elytris fortiter seriatim punctatis, punctis internis solis confusis: tibiis anticis tridentatis, tarsis anticis anteanis palpisque rufis, unguibus dente ad medium armatis. Long. .32.

One specimen found by Dr. Thomas H. Webb, of the United States and Mexican Boundary Commission, in the valley of the Gila. The form is that of most *Diplo-taxis*, but the spiracles of the propygidium are prominent as in the last species. The mandibles are less prominent than usual, and in fact hardly visible. The propygidium and pygidium are sculptured as in the preceding; the tooth of the claws is perpendicular, and not large.

C. *Spuriæ*.

27. *D. brevidens*, oblonga, convexa, fusco-ferruginea nitida, capite confertim fortius punctato, subrotundato, clypeo marginato, antice submarginato, clypeo frontali profunda, thorace fortius punctato, lateribus antice obliquis, dein rotundatis, angulis posticis valde obtusis, utrinque ad apicem et ad medium foveato, elytris grossius seriatim punctatis, punctis internis solis confusis, tibiis anticis valde tridentatis, unguiculis medio fortiter dentatis. Long. .42.

One specimen found by Dr. Thos. H. Webb in the valley of the Gila. This species repeats the form of the fifth division, as the next does the second of the genuine *Diplo-taxes*. The mandibles are more prominent than usual, and bent downwards, so that the ligula is covered by them. The pygidium and propygidium are very coarsely punctured, and the latter has the usual transverse impression near the apex. The apical foveæ of the thorax are half way between the middle line and the angles, the others are near the side, and at the greatest breadth.

28. *D. Haydenii*, oblonga-ovata, rufo-ferruginea, nitida, convexa, capite sat dense punctato, clypeo fere hemihexagono marginato, sutura frontali profunda, fronte transversim obsolete elevata, thorace

modice punctato, brevi, ante medium valde angustato, lateribus obliquis, ad medium fere angulatis, angulis posticis obtusis, subimpressis, ad apicem marginato, angulis anticis magis acutis, elytris fortius punctatis, tricostatis, tibiis anticis tridentatis, dente ultimo oblique truncato, unguiculis medio breviter dentatis. Long. .45.

Yellowstone River, Nebraska, Dr. F. V. Hayden. The mandibles are very prominent, and bent at the apex so as to cover the ligula. The sides of the thorax, from a ventral view hardly converge towards the base. The punctures between the smooth lines of the elytra are confused, and somewhat rugous. The pygidium is coarsely punctured and sparsely hairy; the propygidium is more densely punctured, with the usual transverse impression.

29. *D. innoxia*, oblonga, convexa, rufo-ferruginea nitida, capite sat dense punctato, clypeo fere hemihexagono marginato, sutura frontali profunda, fronte transversim obsolete elevata, thorace modice punctato, brevi, ante medium valde angustato, lateribus ibi obliquis, dein æqualiter rotundatis, angulis posticis obtusis subimpressis, ad apicem marginato, angulis anticis acutis, elytris fortius punctatis, tricostatis, tibiis anticis obtuse tridentatis, dente ultimo subtruncato unguiculis breviter dentatis. Long. .4.]

One specimen, Kansas. Closely allied to the preceding, and precisely similar to it in sculpture: the body is, however, not at all ovate, and the sides of the thorax are more regularly and less suddenly rounded. These two species by the strong apical marginal line of the thorax form a passage to the *Rhizotrogi*; many of which they resemble in the form of the claws.

*Species not recognized.*

*Diplotaxis punctato-rugosa* Blanch. Cat. Col. Mus. Paris, 171; Burm. Lamell. 2, 2nd, 263.

*Diplotaxis georgiæ* Blanch. ibid.

*Diplotaxis frondicola*† Blanch. ibid.

*Diplotaxis castanea* Burm. Lamell. 2, 2nd, 262; an *D. subcostata*?

*Diplotaxis corpulenta* Burm. ibid. 263.

*ALOBUS* Lec.

*Corpus* elongato-oblongum, subcylindricum: caput majusculum, clypeo marginato, antice subrotundato, sutura frontali bisinuata; labrum transversum late emarginatum; palpi maxillares articulo ultimo tenui cylindrico, reliquis coniunctis æquali; mandibulæ prominulæ ad apicem obtusæ: mentum quadratum haud impressum; antennæ breves 10-articulatæ, clava parva triphylla. Tibiæ anticæ tridentatæ unicalcaratæ, posteriores tenues haud coronatæ, nec ad apicem incrassatæ, posticæ intus parce pilosæ; tarsi tibiis vix longiores, subtus parce pilosi vel setosi, haud spinulosæ; ungues omnes dente inferno maximo truncato, ungue ipso haud brevior. Thorax membranula apicali nulla.

A genus which approaches the *Rhizotrogi* in another direction, viz., by the absence of the apical membrane of the thorax; nevertheless by the abdomen and by the labrum it must clearly be associated with *Diplotaxis*.

- A. *fulvus*, elongatus, subcylindricus, testaceo-rufus nitidus, capite fusciscente, confertim punctato, clypeo vix hemihexagono, anguste marginato, sutura frontali impressa, thorace latitudine plus duplo brevior, dense, medio parcius punctato, antrorsum haud angustato, lateribus late rotundatis, angulis posticis obtusis; elytris fortiter punctatis, subtricostatis, propygidio subtiliter, pygidio grosse punctato. Long. .36.

One specimen, New York. The three teeth of the anterior tibiæ are near together.

The head is hardly one-fourth narrower than the thorax, which differs remarkably in form from that of any other species in the group, in not being conspicuously narrowed in front. The under surface is coarsely punctured, more sparsely at the middle of the metasternum; the punctures support very short hairs.

#### 5. SERICÆ.

This group is readily known from all the others by the labrum being connate with the clypeus, and very frequently indistinct; in addition, the anterior coxæ are conical and prominent; the abdominal segments are hardly connate, the penultimate dorsal and ventral are separated by a straight suture, and the stigma is concealed in the anterior angle.

The genus *Serica* *M'Leay*, the only one found in our territory, belongs to the division of genuine *Sericæ*, having the posterior coxæ dilated, and the ligula corneous and connate with the mentum; it may be thus separated into two groups:

- A. Clypeus utrinque acute incisus; corpus haud micans. Sp. 1—4. *Camptorhina* *Kirby*.
- B. Clypeus simplex; corpus sericeo-micans. Sp. 5—15. *Serica* (proper).

#### SERICA *M'Leay*.

##### A.

1. *S. vespertina*, oblongo-ovata, convexa picea nitida, margine breviter fimbriata, clypeo densius, capite thoraceque sat dense punctatis, fronte transversim impresso, elytris sulcatis, sulcis in fundo confluentur fortiter punctatis, interstitiis parce punctatis. Long. .35—.42.

Dej. Cat.; Leconte, Agassiz' Lake Superior, 226.

*Melolontha vespertina* Schönh. Syn. Ins. Append. 94; Say, Journ. Acad. Nat. Sc. 3, 244.

*Omaloplia vespertina* Harris, Ins. Inj. Vegetation, 2nd ed. 29.

*Serica vespertina* Burm. Lamell. 2, 2nd, 175.

*Camptorhina atricapilla* Kirby, Fauna. Bor. Am. 129.

Middle, Southern, Eastern and Western States, as far as Lake Superior.

2. *S. texana*, oblonga convexa, testacea margine breviter fimbriata, clypeo confertim punctato, ad apicem truncato, paulo magis producto, capite parce, thorace subtilius sat dense punctato, elytris sulcatis, sulcis in fundo punctatis, interstitiis punctis paucis notatis. Long. .32.

Found at Fort Gates, Texas, by Mr. H. Haldeman. This species is smaller than the preceding, and less dilated behind; the clypeus is longer, the lateral incisure of the anterior part is not so deep, the thorax is more convex and more finely punctured, and the elytra are less punctured.

3. *S. atratula*, oblongo-ovata, piceo-nigra, margine vix breviter fimbriata, clypeo confertim punctato antice truncato, fronte transversim impressa, capite parcius, thorace densius punctato, elytris profundius sulcatis, sulcis in fundo punctatis, antennis palpisque rufo-flavis. Long. .26.

One specimen from Texas, Mr. H. Haldeman. Differs from the preceding by the more ovate body dilated behind, by the transversely impressed front, the more strongly punctured thorax, and more deeply sulcate elytra. The clypeus, as in *S. texana*, is less deeply incised at the side than in *S. vespertina*.



4. *S. serotina*, oblonga, subovata, convexa, piceo-rufa, nitida, margine longius fimbriata, clypeo truncato dense, capite parce punctato, fronte transversim impressa, thorace convexo subtiliter sat dense punctato, linea dorsali postice lævi, elytris leviter sulcatis, sulcis in fundo punctatis, antennis flavis. Long. .42.

One specimen collected at Sacramento, California, by Mr. J. Wittick, and given me by Mr. Rathvon. Of the size of *S. vespertina*, but less dilated behind. The clypeus is broader in front than in any of the preceding species, the lateral incisure is slight. The thorax is very convex, much rounded on the sides, and more finely punctured than in the others; the pectus and coxæ are uniformly and densely punctured, while in the other species the punctures are denser on the coxæ, and gradually become sparse at the middle of the pectus. The hairs which fringe the edge of the thorax and elytra are longer than in the other species.

## B.

5. *S. iricolor*, ovata convexa, nigra, iridescens, capite thoraceque dense punctatis pilis fulvis erectis dense vestitis, elytris sulcatis, punctatis parcius pilosis, antennis testaceis. Long. .29.

Burm. Lamell. 2, 2nd, 178.

*Melolontha iricolor* Say, Journ. Acad. Nat. Sc. 3, 245.

Middle States. By some strange error this species is placed in the Melsheimer Catalogue of Described Coleoptera as synonymous with *Mel. micans* Knoch.

6. *S. fimbriata*, oblongo-ovata, testacea opaca convexa, subiridescens, capite dense punctato, clypeo ad apicem reflexo et late emarginato, thorace minus dense punctato, lateribus magis oblique rotundatis longe fimbriatis, elytris striis uniseriatim punctatis, pectore coxisque longe sat dense flavo-villosis. Long. .42.

San Diego, California. Of the same size, but more robust than *S. sericea*, and very distinct by the more oblique sides of the thorax being fringed with long lateral hairs, and by the hairy breast. The striæ of the elytra are not irregularly punctured as usual, but have only single rows of punctures. It is possible that dark colored specimens may occur, as mine, although found flying in the evening twilight, do not appear to have become fully hardened.

7. *S. tristis*, oblongo-ovata, nigro-picea nitida, convexa, obsolete iridescens, clypeo plano, dense punctato, antice emarginato, vix reflexo, capite parce, thorace sat dense fortiter punctatis, lateribus oblique rotundatis, elytris parce punctatis, striatis, pygidio parce punctato, antennis testaceis, pedibus piceis. Long. .32—.35.

Lec. Agassiz' Lake Superior, 226.

North shore of Lake Superior. Resembles in form the next species, but the thorax is broader. The body above and beneath is shining with but little iridescent lustre; the clypeus is flatter in front, hardly margined, and the space in front of the transverse fine line is longer.

8. *S. sericea*, piceo-purpurea vel nigro-purpurea, opaca, scriceo-micans, oblongo-ovata, convexa, margine parce fimbriata, clypeo dense punctato, antice emarginato et reflexo, thorace lateribus oblique paulo rotundatis, sat dense punctato, elytris striatis præcipue in fundo striarum punctatis, pygidio sat dense punctato, antennis pedibusque piceis. Long. .37.

Burm. Lamell. 2, 2nd, 176.

*Melolontha sericea* Illiger's Oliv. 1, 5, 75 (fide Burm.); Say, Journ. Acad. Nat. Sc. 3, 245.

*Melolontha variabilis*† Fabr. Syst. El. 2, 182 (var.)

Middle and Southern States, common. The male is oblong, hardly dilated behind; the female is distinctly ovate.

9. *S. curvata*, elongata, testacea, convexa, supra opaca, subiridescens, subtus nitida, margine fimbriata, clypeo confertim punctato, ad apicem subtruncato et reflexo, thorace subtilius punctato, lateribus valde rotundatis, elytris minus profunde striatis, et in striis punctatis, pygidio subtilius punctato, nitido. Long. .28.

Kansas, in the valley of Platte River. Smaller and narrower than the preceding, and readily known by the strongly rounded sides of the thorax.

10. *S. mixta*, oblonga, testacea subopaca griseo-iridescens, margine longe fimbriata, clypeo dense punctato, antice subrotundatim truncato, thorace lateribus antice magis rotundatis, subtilius punctato, elytris parce punctatis, striatis, interstitiis alternatim latioribus et magis punctatis, pectore villosulo. Long. .34.

San Diego, California. Larger and narrower than the next, but smaller than *S. fimbriata*, and differing from both by the clypeus being almost rounded in front without distinct lateral angles, as well as by the form of the thorax. The breast is more hairy than usual, though less so than in *S. fimbriata*, and the hind coxæ are nearly glabrous.

11. *S. alternata*, oblongo-ovata convexa, purpureo-picea, iridescens, clypeo dense punctato, antice latius subemarginato, et reflexo, thorace punctato lateribus oblique magis rotundatis, parce fimbriatis, elytris punctatis, striatis interstitiis alternis conspicue latioribus, et magis punctatis, lateribus fimbriatis, pectore parce villosulo. Long. .28—.34.

San Diego, California. Of the color size and form of *S. sericea*, but the thorax is broader, more rounded on the sides and more strongly fringed: the elytra are less deeply striate, with the punctures more equally scattered over the interstices.

12. *S. anthracina*, brevius ovata, convexa, atra opaca, paulo iridescens, clypeo confertim punctato, antice vix emarginato, reflexo, thorace punctato, lateribus oblique magis rotundatis parce fimbriatis, elytris punctatis, subtiliter striatis, interstitiis planis, pygidio fortius punctato, coxis posticis dense punctatis. Long. .36.

Oregon, Dr. Townsend, and others.

13. *S. frontalis*, breviter ovata, picea, subnitida, paulo iridescens, clypeo confertim punctato, marginato, antice subemarginato, fronte inter antennas linea elevata in vertice subangulata notata, thorace punctato, lateribus oblique magis rotundatis, parce fimbriatis, elytris parce punctatis fortius striatis, pygidio subtiliter punctato, coxis posticis parce fortiter punctatis. Long. .27.

One specimen, Oregon, Col. McCall. Closely related to the preceding, but seems to differ in the slight transverse angulated frontal line, and the sparsely punctured posterior coxæ; the elytra are more deeply striate but less punctured, and the pygidium is more finely punctured.

14. *S. robusta*, breviter ovata, nigra, nitida, subiridescens, clypeo confertim punctato, marginato, antice sub-

emarginato, thorace sat dense punctato, lateribus valde rotundatis, elytris parcius punctatis, striatis, pygidio subtilius punctato, coxis posticis parce fortiter punctatis. Long. .3.

Sacramento, California, collected by Mr. Wittick, and given me by Mr. S. S. Rathvon. This species differs from the two preceding by the greater roundness of the sides of the thorax, which is slightly wider at the middle than at the base. The hairs of the sides are shorter and fewer in number; those of the sides of the elytra are about as usual.

15. *S. trociformis*, ovata, convexa nigra subnitida, paulo iridescens, clypeo fortiter punctato, marginato, antice subemarginato, thorace lateribus obliquis paulo rotundatis, fortius sat dense punctato, elytris sæpe fulvis, profunde striatis et in fundo striarum punctatis, pygidio parce fortius punctato, coxis posticis fortiter haud dense punctatis, antennis tibiis tarsisque plus minusve rufescentibus. Long. .25.

Burm. Lamell. 2, 2nd, 179.

*Omaloquia trogiformis* Uhler, Proc. Acad. Nat. Sc. Philad. 7, 415.

? *Melolontha aphodiina* Billberg, Mem. Acad. St. Petersb. 7, 386, fig. 7. (fide Burm.)

Middle and Southern States, not common. The difference in color would tempt many to separate the variety with fulvous elytra, but, although intermediate specimens do not occur, no difference in form or sculpture exists.

#### 6. MACRODACTYLI.

Among the divisions with prominent conical anterior coxæ, this is distinguished by the upper lip being small and beneath the prolonged clypeus, the mentum channeled, narrow, the segments of the abdomen not connate, the fifth always longer than the others, and finally by the unguis being mostly equal and diverging, and not capable of being folded along the joint. The genera are numerous, and entirely confined to America; only one is found within our limits.

#### MACRODACTYLUS Latr.

1. *M. subspinosus*, (testaceus? vel) nigro-fuscus, undique dense pollinoso-squamulosus, thorace convexo latitudine parum longiore, pilis brevissimis suberectis parce vestito, elytris fundo testaceis, ano setoso, antennis pedibusque testaceis, tarsis nigro-annulatis. Long. .4.

Latreille, Cuvier's Regne Animal, 4, 562; ed. Amer. 3, 427; Enc. Meth. 10, 372; Laporte, Hist. Nat. 2, 147; Harris, Ins. Inj. Veget. ed. 2nd 30; Burm. Lamell. 2, 2nd, 57. (synon. exclusiva.)

*Melolontha subspinosa* Fabr. Syst. El., 2, 181; Oliv. 5, 70, tab. 7, fig. 73; Latr. Gen. Crust. et Insect., 2, 110.

New York. The abdomen of the female is black and entirely free from bristles; that of the male is testaceous, and at the middle of each segment are long bristles, without order, and more numerous than in *M. elongatus*. Like the other species it is very destructive to roses.

2. *M. setulosus*, testaceus (vel nigro-fuscus?) undique dense pollinoso-squamulosus, capite thoraceque nigris, hoc convexo latitudine parum longiore, pilis erectis sat dense vestito, elytris (fundo testaceis) pilis longis erectis versus basin parce vestitis, pygidio et ano longe piloso, antennis pedibusque testaceis, tarsis nigro-annulatis. Long. .4.

One specimen from Georgia. Differs from the preceding by the longer erect hairs of the thorax and by the long hairs of the pygidium and base of the elytra. The color beneath is entirely testaceous, but specimens will probably occur of a darker color. The abdomen is convex like that of a female, but there are coarse long bristles scattered on each segment about the middle.

3. *M. angustatus*, testaceus vel niger, undique pube appressa squamulosa pollinosa dense vestitus, capite thoraceque nigris, hoc subconvexo maris latitudine sesqui longiore, elytris fundo testaceis, ano setoso, antennis pedibusque testaceis, tarsi nigro-annulatis. Long. .35.

*Melolontha elongata*|| Herbst, Col. 3, 145, tab. 26, fig. 3.

*Melolontha angustata* Beauv. Ins. 30, tab. 5, fig. 6.

*Macrodactylus polyphagus* Burm. Lamell. 2, 2nd, 57.

Southern States, Kansas, and as far south-west as Chihuahua. This species is more slender in its form and is readily known from the others by the longer thorax and total absence of erect hairs. Herbst in the description insists so strongly on the "flachliegenden Härchen," that I have considered the species as known to him. The characters given by Burmeister are relative, except that he states the anus to be testaceous. It is so in all the specimens before me, but sometimes too the whole abdomen is of the same color. The abdomen of the female is large and convex, with a few bristles at the middle of the four anterior joints; that of the male is more compressed, with numerous spine-like bristles arranged in rows each side of the middle.

## 7. DICHELONYCHÆ.

A small group, confined to the American continent, and of which the well known genus from which it derives its name is the sole representative within our territory. As a group, it is distinguished from foreign groups among the Melolonthidæ with prominent conical anterior coxæ, free labrum and abdominal segments, by the ligula being connate with the mentum, the labrum large, vertical and deeply emarginate, and by the sternum not being protuberant. The thorax as in *Diptotaxes* has a narrow apical membranous margin. With regard to the position of the group, Lacordaire forms with it the passage from the *Sericoides* to the *Macrodactylides*; from the latter of which it differs according to his classification by the fifth ventral segment not being larger than the others. I find, however, in *Macrodactylus* that the difference in size of the segments is by no means obvious, and I am inclined, therefore, with Burmeister to rank the present as a sub-group of *Macrodactylidæ*, verging indeed by the freely moving and prehensile claws to the *Hoplidæ*.

### DICHELONYCHA Kirby.

Our species which have become tolerably numerous may be thus grouped.

Thorax haud vel vix canaliculatus	-	-	-	-	-	-	I. Sp. 1—9.
Thorax valde canaliculatus	-	-	-	-	-	-	II. 9—13.

The males are more slender in form than the females, and are distinguished by the club of the antennæ being as long as the funiculus.

## I.

1. *D. elongata*, elongata, subtus testacea, capite thoraceque nigricantibus testaceo limbatis, illo fortius confluent, hoc dense punctato cinereo-pubescente subcanaliculato, hexagono, lateribus angulatis, antice posticeque paulo concavis, angulis posticis acutis valde prominulis, elytris æneo-testaceis virescentibus, fortiter punctatis, breviter pubescentibus, vix trilineatis. Long. .33.

Burm. Lamell. 2, 2nd, 74.

*Melolontha elongata* Fabr. Syst. El. 2, 174.

*Melolontha elongatula* Schönherr, Syn. Ins. 3, 210.

*Melolontha hexagona* Germ. Ins. Sp. Nov. 124.

? *Dichelonycha virescens* Kirby, Fauna Bor. Am. 4, 134.

Pennsylvania, New York, Massachusetts, Michigan and Lake Superior. Very abundant whenever found. Varies in color, the head and thorax being sometimes almost rufous; the elytra are uniformly bronzed, the suture and a narrow margin only being pale. The lateral angles of the thorax are rounded, and the scutel is pubescent. The legs are yellow; the tarsi and posterior tibiæ are more or less tinged with blackish. I have placed a query to the synonym of Kirby, as his var. C. (which he supposes may be different from the type) evidently belongs to the next species, which from want of attention to the form of the thorax (a character that has been omitted by previous authors) may be readily confounded with the present.

2. *D. subvittata*, elongata, testacea vel fusco-testacea, capite fortius confluent punctato, piceo antice testaceo, thorace pubescente piceo, testaceo-limbato, sat dense punctato, hexagono, lateribus fere acute angulatis, antice posticeque parum concavis, angulis posticis subacutis prominulis, elytris æneo-testaceis vitta lata sublaterali virescente, densius rugose punctatis breviter pubescentibus, vix trilineatis, pedibus totis flavis. Long. .4—46.

*Dichelonycha virescens* var. C.† Kirby, Fauna Bor. Am. 4, 135.

Lake Superior, abundant. The scutel is densely pubescent. The green vitta of the elytra is broad and curves around the tip; it is sometimes interrupted. The form is a little stouter than that of *D. elongata*.

3. *D. testacea*, minus elongata, testacea, capite confluent punctato, thorace pubescente, sat dense subtilius punctato, antice angustiore, lateribus rotundatis subangulatis, postice vix sinuatis, angulis posticis subacutis, elytris breviter pubescentibus æneo-tinctis, fortiter punctatis, subtrilineatis. Long. .4.

Kirby, Fauna Bor. Am. 4, 135.

Eagle Harbor, Lake Superior, only two females were found. Differs from the preceding by the broader form and almost regularly rounded sides, as well as by the finer punctures of the thorax. From the following species it differs by the same characters and also by the pubescence of the thorax being as fine as that of the elytra.

4. *D. linearis*, elongata, testacea, capite thoraceque sæpe piceis, illo modice marginato confluent, hoc densissime punctato, pilis grossis ochreis dense vestito, lateribus angulatis postice oblique sinuatis, elytris

æneo-testaceis, fusco-æneo vel æneo-viridibus, confertim rugose punctatis margine testaceo, tibiis posticis ad apicem, tarsisque nigricantibus. Long. 34—41.

Burm. Lamell. 2, 2nd, 74.

*Melolontha linearis* Gyllenhal, Schönherr, Synon. Ins. 3, 103.

'*Dichelonycha Backii* Kirby, Fauna Bor. Am.† Burm. Lamell. 2, 2nd.

Middle States and Lake Superior. When the hair of the thorax has been removed, as is sometimes the case, this species may be known by the very dense, but not fine punctures of the thorax, the base of which is wider than the apex, and the sides angulated at the middle. There appears to be a variation in the form of the basal angles, sometimes they are subacute and moderately prominent, sometimes rectangular, and sometimes obtuse; they are never very acute and prominent as in *D. elongata*. It is possible that by comparing specimens from different localities several closely allied species here confounded together may be separated.

One female from Maryland has the posterior angles more prominent, and the elytra of a dull brownish bronze color. The thorax appears more coarsely punctured, but it is unsafe to propose a new species upon this single specimen.

5. *D. fulgida*, picea, elongata, capite thoraceque piceis vel piceo-rufis, illo tenuiter marginato confluent, hoc fortius medio minus dense punctato, pilis grossis æneo-flavis dense vestito, lateribus subangulatis, postice oblique subsinuatis, angulis posticis subrectis, elytris fortiter punctatis, vix trilineatis, breviter pubescentibus, viridiæneis, vix lineatis, margine testaceis, antennis pedibusque flavis, tibiis tarsisque infuscatis. Long. 37.

Steilacoom, Washington Territory, Dr. Suckley. Allied closely to the preceding, but the thorax is less densely and more strongly punctured, less suddenly angulated on the sides, and less narrowed behind, and the reflexed margin of the clypeus is very narrow.

6. *D. Backii*, nigro-picea, elongata, capite confluent punctato, fortius marginato, thorace fortiter sat dense punctato, spatio utrinque sublævi (dense fortius pubescente?) lateribus rotundatis subangulatis, angulis posticis obtusis, elytris læte viridiæneis, margine testaceo, rugose punctatis sublineatis, antennis pedibusque nigro piceis, his rufo-tinctis. Long. 33—39.  
Kirby, Fauna Bor. Am. 4, 134, tab. 2, fig. 6.

North side of Lake Superior. Burmeister places this as synonymous with *D. linearis*; my specimens are however clearly different, not only by the dark colored antennæ, but by the more strongly margined clypeus, and by the more coarsely and less densely punctured thorax; on each side of the disc anteriorly, near the lateral fovea is an indistinct space which is less punctured; the sides are less angulated, and not at all sinuate behind. The specimens were found floating in the lake, and had lost nearly all the pubescence; from the appearance of what remains on the side of the thorax, I believe that the hair was coarse and probably dense as in *D. linearis*. Kirby does not mention this character, but it may have been lost in the alcohol in which the specimens were preserved; the hair of the under surface, being better protected, has been preserved in both his specimens and mine.

7. *D. fuscula*, elongata, rufo-testacea vel nigra, supra æqualiter fortius pallide pubescens, capite fortius confluent punctato, margine antico vix rotundato, thorace minus dense punctato, lateribus subangulatis, rotundatis, antrorsum paulo angustiore, angulis posticis obtusis, elytris nigro-piceis, ænescentibus, margine testaceo, dense rugose punctatis, antennis rufis. Long. .3—37.

Middle and Southern States. The legs vary with the body from yellowish red to nearly black, but are uniform in color; the pectus in paler specimens is somewhat fuscous.

8. *D. truncata*, elongata, nigro-picea, æqualiter dense fortius pallide pubescens, capite confluent punctato, margine reflexo testaceo, antice recte truncato, angulis haud rotundatis, thorace dense punctato et parce punctato, lateribus rotundatis obtuse angulatis, angulis posticis obtusis, elytris virescentibus margine testaceo, confertim fortius rugose punctatis, abdomine sæpe testaceo, antennis pedibusque flavo-testaceis. Long. .25.

Platte River, Kansas Territory. Easily known by the truncate clypeus with almost prominent angles.

9. *D. rotundata*, elongato-ovalis, picea, subænea, clypeo hemihexagono, fortiter punctato, anguste marginato, thorace latitudine duplo brevior, convexo disperse punctato, obsolete canaliculato, ante medium angustato, lateribus antice obliquis, postice cum basi fortiter rotundatis, angulis posticis omnino nullis, elytris fortius punctatis tenuiter pubescentibus, lineis parum distinctis. Long. .31.

One very dilapidated dead specimen found at Vallecitas, San Diego County, California. The oblique sides of the truncate clypeus, forming half of a hexagon, and the posteriorly very much rounded sides of the thorax will readily distinguish it.

## II.

10. *D. valida*, elongata, nigro-picea, supra parcius, thorace fortius albo-pubescens, capite confluent punctato, vertice angulatim vage impresso, occipite sublævi, thorace inæqualiter grosse punctato hexagono, lateribus ante medium rotundatim fortiter angulatis, angulis posticis valde obtusis, canaliculato, versus latera paulo inæquali, elytris confertim rugose punctatis, fusco-æneis virescentibus, margine, ore antennis pedibusque piceo-testaceis, tarsis obscurioribus. Long. .55.

A female found by Mr. Joshua Child at San Francisco, California, was given me by Mr. S. S. Rathvon. It is very distinct by its large size and other characters. As in the next species the greatest breadth of the thorax is in front of the middle.

11. *D. albicollis*, elongata, picea vel piceo-testacea, supra fortius albo-pubescens, capite confluent punctato, clypeo testaceo, thorace longius pubescente fortius subinæqualiter punctato, hexagono, lateribus ante medium rotundatim fortius angulatis, angulis posticis valde obtusis, canaliculato, versus latera inæquali, elytris virescentibus margine testaceo, confertim rugose punctatis, lineis utrinque elevatis tribus subglabris, ore antennis pedibusque testaceis. Long. .44—.5.

Burm. Lamell. 2, 2nd, 74.

Middle States and Lake Superior. Not common. The pubescence of the scutellum is very dense and white.

12. *D. sulcata*, elongata, nigro-picea, fortius albo-pubescens, capite confluent punctato, vertice angulatim vage impresso, occipite medio sublævi, clypeo margine testaceo, thorace cælato, profunde canali-



culato, partibus impressis grosse punctatis et pubescentibus, elevatis lævibus glabris, lateribus ante medium rotundatim valde angulatis, angulis posticis valde obtusis, elytris dense rugose punctatis sublineatis, fusco-æneis, margine, ore antennis pedibusque flavo-testaceis, tarsis, tibiæ et tibiæ margine interno nigricante. Long. .43.

Sante Fe, New Mexico, Mr. Fendler. The impressions of the thorax, which are coarsely punctured and pubescent, are a deep dorsal groove, another interrupted groove each side, and some impressions about the sides. The scutellum densely pubescent as in the preceding.

13. *D. pusilla*, elongata nigro-picea, fortius minus dense albo-pubescent, margine et pygidio et subtus longius parce pilosa, capite dense punctulato et parce punctato, clypeo margine testaceo antice recte truncato, angulis vix rotundatis, thorace hexagono angulis omnibus obtusis, parce inæqualiter punctato, canaliculato, elytris fusco-æneis lineis tribus subglabris; antennis nigris, pedibus piceo-testaceis. Long. .27.

San Diego, California. So distinct from all the others as to need no further description. The size is about that of *D. truncata*, which it resembles in having the clypeus truncate, but the angles though rectangular are less marked.

#### 8. LASIOPODES.

In this group I have comprised two genera, containing species of small size, living upon flowers. Although differing remarkably in appearance and characters, not less from each other than from all other genera of the tribe known to me, I have been induced to associate them together on account of the following characters, which they have in common.

The anterior coxæ are large, conical and protuberant; the abdomen is very small, and the sutures between the anterior segments are nearly effaced; the last segment is conical, free, and larger than usual. The parapleuræ are narrow. The claws are diverging, with a very short bisetose onychium; the posterior tibiæ are armed with two spurs, but the anterior tibiæ have no spur.

#### LASIOPIUS Lec.

Clypeus rotundatus, valde concavus, ad apicem submarginatus; mentum parvum lineare; pedes postici incrassati; ungues simplices elongati.

Body oval, elongate convex, fringed at the sides and beneath, and on the legs with very long hairs. Head small, eyes large, hardly emarginate, clypeus rounded, deeply concave, slightly emarginate at tip, separated from the head by a deep transverse concave line. Mouth small, labrum and mandibles invisible; mentum small, narrow, not larger than the base of the maxillæ. Palpi slender. Antennæ 9-jointed; first and second joints thick, hairy; four following small; club three jointed, small. Thorax rounded on the sides, convex, narrower in front. Elytra elongate, convex, partly covering the pygidium. Legs strong, hairy; anterior tibiæ subtridentate; middle tibiæ conical, with a crown of spines externally at the middle, and two terminal

spurs; posterior thighs very large, posterior tibiæ like the middle ones, but much thicker. Tarsi twice as long as the tibiæ, slender, with verticillate hairs at the articulations; last joint with two long terminal hairs above; unguis long, slender, diverging onychium hardly visible, bisetose.

I have given to this genus an unpublished name proposed by Dejean for *Aclopus Erichson*, to which genus this seems to bear a remarkable resemblance in form. The labrum and mandibles are however entirely invisible. I regret that I cannot give the position of the abdominal stigmata, but conclude that they must be very much as in the next genus.

1. *L. ferrugineus*, valde elongatus ovalis, nitidus ferrugineus, capite punctato, clypeo parce punctato, thorace minus dense inæqualiter punctato, ad basin lævi, antice subcanaliculato, lateribus longe fimbriatis, elytris parce punctatis, punctis subseriatis extrorsum confusis, breviter parce pilosis, margine fimbriatis; subtus et pedibus parce longe pilosis. Long. .19.

Ringgold Barracks, Texas. We owe this most interesting addition to our fauna to the scientific industry of Mr. H. Haldeman. The genus will be readily recognized by the narrow oval body, fringed with long hairs, and by the long hairs of the legs, and the thickness of the posterior femora and tibiæ.

#### ONCERUS Lec.

Clypeus duplex; mentum trapezoideum barbatum; pedes postici incrassati; unguis fissi.

The only species of this genus known to me is the smallest of the tribe that I have seen, and presents such a curious assemblage of characters that I am at a loss which to select. The form might be compared to a *Hoplia*, oblong and more narrowed in front; the body is shining, sparsely hairy, especially beneath. The head is narrow with convex prominent eyes, the clypeus prolonged, flattened, parallel on the sides, rounded slightly at the apex and incised each side, with a deep transverse concave suture between the incisions; the frontal suture is straight and deep, running between the antennæ which are short; the first and second joints are thick and hairy; then follow four small joints, and then a small three-jointed club concave outwards; the mentum is large, flat, trapezoidal, wider in front, with long scattered hairs; the bases of the maxillæ are long, slender and prominent each side of the mentum; the maxillary palpi are slender, penultimate joint small, last joint elongate, slightly oval; labial with the last joint longer than the preceding, slightly oval. Thorax wider than the head, rounded on the sides, and gradually narrowed in front. Elytra a little wider than the base of the thorax, oblong, slightly flattened on the disc, with the sutural stria fine. Pygidium slightly exposed. Legs strong, hairy, anterior tibiæ subbidentate; middle tibiæ conical, moderately thick, with a crown of short spines at the middle externally, and two apical spurs. Posterior thighs very large, tibiæ thick conical, with a crown of spines externally about one-third from the tip, and two apical

spurs. Tarsi slender, longer than the tibiæ, with verticellate hairs; unguis diverging, armed with a tooth so long that they appear cleft; onychium short bisetose.

1. *O. floralis*, niger, nitidus, capite rude, thorace parce punctatis, hoc margine longe piloso, elytris piceo-testaceis, fortiter disperse punctatis, breviter pallide pilosis, subtus longius parce pilosus. Long. .13—.16.

Found at Vallecitas, San Diego Co., California in April, on flowers of a composite plant. I can find no sexual characters in the specimens collected. By examination I find the abdominal stigmata situated in the dorsal inflexed portion of the ventral segments; the last pair I cannot detect, since the margins of the ventral segments are thin and reflexed above the dorsal surface, so as to produce a concave surface, in which the posterior pairs are concealed.

#### 9. HOPLIÆ.

This division is known among those having prominent conical anterior coxæ by the ventral segments being connate, the sixth indistinct or even invisible; by the large parapleuræ; the tibiæ without terminal spurs or at most with a single very small one, and by the unguis being chelate (*i. e.* capable of being folded against the last joint of the tarsi,) not divergent, unequal and without any onychium.

In this division, though not in any American form, is found a modification of ligula not seen or only exceptionally in any of the preceding tribes; the ligula is membranous, and not connate with the mentum: by this character, found in *Pachynemis* and allied genera, the passage to the following group is most naturally made.

The only genus found in our country, and in fact the only one found outside of Southern Africa, is

#### HOPLIA Illiger.

##### A. Unguis minor anticus et medius duplo vel plus duplo brevior.

1. *H. laticollis*, oblonga, latiuscula, picea opaca, supra æqualiter parcius, subtus et pygidio densius pallide squamulosa, et parce brevissime pubescens, thorace latitudine brevior, lateribus obliquis rotundatis fimbriatis, parce breviter pubescente, elytris sordide testaceis subcostatis, unguibus anterioribus fissis, minoribus plus duplo brevioribus, postico integro. Long. .30—.33.

New Mexico and Kansas; the anterior tibiæ, as in the others of this group, have two large teeth and a small one above, which is sometimes indistinct. The antennæ as in the other species are 9-jointed. The scales of the elytra are narrower than those of the under surface.

2. *H. Oregona*, oblonga, latiuscula, nigra, breviter pubescens, subtus et pygidio argenteo-squamosa, supra parcius albo-squamosa, thorace latitudine brevior, lateribus obliquis rotundatis fimbriatis, elytris thorace vix latioribus obscure ferrugineis, bistriatis, unguibus anterioribus . . . , postico integro. Long. .27.

One specimen collected in Oregon, by Dr. J. K. Townsend. Differs from the pre-

ceding by the silvery scales of the under surface and pygidium, and by the stronger pubescence. The thorax is not as wide.

3. *H. convexula*, oblonga, picea, subtus et pygidio parce pubescens, et subargenteo-squamosa, supra parce breviter pubescens, pallide squamosa, thorace latitudine paulo brevior magis convexo, lateribus magis rotundatis, elytris haud costatis; unguibus anterioribus fassis, medio interno plus duplo brevior, postico integro. Long. .24.

One specimen, Sacramento, Mr. Wittick. Resembles the next species in the very small size of the middle inner claw, but differs by the more convex rounded thorax and by the pubescence, which is no longer on the thorax than on the elytra.

4. *H. pubicollis*, oblonga, nigra, subtus et pygidio parce pubescens, subargenteo-squamosa, supra pallide squamosa, capite thoraceque longius pubescentibus, hoc latitudine paulo brevior, lateribus obliquis rotundatis fimbriatis, elytris piceis vix breviter pubescentibus haud costatis, unguibus anterioribus fassis, interno medio plus duplo brevior, postico integro. Long. .28.

Of California, Mr. J. Child. Of the same form as the preceding, but differing by the elytra being free from lines or elevations, and by the longer hair of the thorax.

5. *H. callipyge*, oblonga, nigra, subtus et pygidio parce pubescens, dense argenteo-squamosa, supra pube erecta in thorace longior sat dense vestita, pallide squamulosa, nigro-punctata, thorace convexiusculo, latitudine parum brevior, lateribus fimbriatis obliquis rotundatis, elytris castaneis, costa dorsali parum notata, postice paulo retusis; unguibus anterioribus fassis, minoribus vix duplo brevioribus, postico integro. Long. .30—34.

California, Mr. J. Wittick. Of the same form as the preceding, but distinguished by the pubescent elytra being slightly retuse behind, and concave towards the suture, and by the splendid silvery lustre of the pygidium and under surface. In one specimen the scales of the thorax are more condensed along the middle and sides.

6. *H. debilis*, elongato-oblonga nigra, squamis angustis albis undique minus dense conspersa, parce cinereo-pubescens, thorace pilis longioribus erectis vestito, latitudine vix brevior, lateribus rotundatis haud obliquis, unguiculis anterioribus fassis, postico integro. Long. .25.

One specimen found in Pennsylvania was kindly sent me by Dr. Melsheimer. Of the size and appearance of *H. convexula*, but more elongate, with the sides of the thorax less rounded. The thorax is hardly distinctly narrowed in front, except in consequence of the gradual curvature of the sides, which thus do not appear oblique, nor at all angulated. The elytra are at base wider than the base of the thorax, and somewhat retuse near the apex. The middle claws are wanting, the outer one of the anterior tarsi is one third shorter than the inner one.

7. *H. modesta*, oblonga, nigra, vel testacea, capite thoraceque fuscis, subtus et pygidio parce pubescens, argenteo-squamosa, capite thoraceque pube erecta vestitis, hoc pallide squamuloso, planiusculo, lateribus obliquis parum rotundatis, elytris pilis fusco-pallidis depressis lanceolatis minus dense vestitis, obsolete costatis, sæpe testaceis: unguibus anterioribus fassis, minoribus duplo brevioribus, postico fisso. Long. .24—31.

! Hald. Proc. Acad. Nat. Sc. 1, 304.

*Hoplia singularis* Burm. Lamell. 2, 192.

? *Hoplia monticola* Proc. Acad. Nat. Sc. 2. 141.

Middle and Southern States; varies much in size and color and also slightly in sculpture, the lines on the elytra being sometimes very faint, and at others quite strong; the flattened thorax with oblique but slightly rounded sides, the silvery scales of the under surface, and the hair-like scales of the elytra readily distinguished it from all others.

B. *Unguis minor* anticus et medius paulo, vix sesqui brevior.

8. *H. tristis*, oblonga, nigra, nitida, undique cinereo-pubescent, thorace longius pubescente, latitudine paulo brevior, lateribus obliquis rotundatis, pone medium paulo compressis, elytris subcostatis, pygidio et subtus lanceolato-albo-squamulosa, tibiis anticis subtridentatis, unguibus anterioribus fissis, postico integro. Long. .31.

Mels. Proc. Acad. Nat. Sc. Philadelphia, 2, 141: Burm. Lamell. 2, 2nd, 486.

One specimen from New York. Differs from all the rest by the total absence of scales on the upper surface. The form is rather more similar to the next than to *H. mucorea* with which Burmeister compares it. The anterior tibiae have a small tooth above the two large ones.

9. *H. trifasciata*, oblonga, fusca, subtus, thorace et pygidio squamis subargenteis dense tecta, capite thoraceque pube erecta vestitis, hoc antrorsum angustato latitudine brevior, lateribus subangulatis, elytris castaneis, parce breviter pubescentibus, squamulis pallidis, inaequaliter vestitis, fasciis transversis tribus parum distinctis formantibus, tibiis anticis subtridentatis, unguibus anterioribus fissis, postico integro. Long. .33—.44.

Say, Journ. Acad. Nat. Sc. 3, 200.

? *Hoplia primaria* Burm. Lamell. 2, 192.

*Hoplia helvola* Melsheimer, Proc. Acad. Nat. Sc. Phil. 2, 142.

Newfoundland, Lake Superior, New York, Georgia, Illinois. Varies somewhat in characters, the elytra being sometimes almost free from scales, at others almost uniformly clothed with them. Such a specimen would appear to be described by Burmeister, and such a one is now before me; the upper tooth of the anterior tibiae is almost obliterated in it, and might readily be overlooked, as seems to have been done by Burmeister when he described them as bidentate. I have seen no black specimens like the male described by Say.

10. *H. limbata*, longiuscula, atra, subtus et pygidio laete argenteo-squamosa, supra breviter pubescens, griseo parce squamosa, thorace pilis paucis longioribus intermixtis, latitudine haud brevior, utrinque angustato, lateribus fortius angulatis, late dense albo-squamosis, subargenteis, lineaque postica dorsali alba signato, elytris thorace latioribus, basi, margine externo pone basin, suturaque ad medium et ad apicem dilatata albosquamosis, subargenteis, tibiis anticis bidentatis, unguibus omnibus fissis. Long. .34.

Two specimens found at Evansville, Indiana. The dilatation of the white suture at the middle forms an oblique fascia reaching two-thirds way to the suture; the posterior dilatation is a spot connected both with the suture and tip. The thorax is hardly narrower at tip than at base. The legs are black, with the thighs sparsely sprinkled with silvery scales.

11. *H. mucorea*, elongata, nigra, subtus et pygidio sordide albo-squamosa, supra virescente-ochreo-squamosa, capite vix squamoso thoraceque haud dense longe pilosis, hoc latitudine haud brevior, antice angustiore, lateribus fortius angulatis, convexiusculo, elytris thorace haud latioribus, tibiis anticis bidentatis, unguibus anterioribus fassis, postico . . . . Long. .28.

Burmeister, Lamell. 2, 193; ibid. 2, 2nd, 486, (synon. exclusa).

*Melolontha mucorea* Germ. Ins. Nov. 129.

Southern States. Readily known by the more elongate and parallel form. The posterior tarsi are broken, so that I do not know whether the claw is simple or bifid. I have excluded *H. helvola*, as a synonym, since the description mentions linear scales on the elytra; it seems to me rather to be the variety of *H. trifasciata* with almost uniformly colored elytra, and this view accords with the measurements given.

*H. monticola*, Mels. Proc. Acad. Nat. Sc. Phila. 2, 141, I have failed to identify. The dimensions given are  $3\frac{1}{4}$  lines by  $1\frac{1}{2}$ , which are the proportions of *H. mucorea*. From notes sent me by Dr. Melsheimer, it would seem to differ from both that species and *H. modesta*. The color is brownish testaceous, the head and thorax are darker, the latter clothed with short rufous hairs and sprinkled towards the sides with whitish scales, 'the sides are somewhat dilated beyond the middle, slightly incurved posteriorly, subrectilinear from its widest portion to the tip; elytra hardly wider at the base than the base of thorax', more than twice as long as the thorax, clothed with short rufous hairs, two obsolete longitudinal raised lines near the middle, pygidium clothed like the elytra, venter covered with small whitish scaly hairs. 'Anterior tibiæ bidentate; inner middle claw less than one half the size of the outer one: posterior claw entire.' Pennsylvania, in Adams County.

Should the last character be erroneous, it might be referred to the light colored specimens mentioned under *H. modesta*.

## 10. GLAPHYRI.

A group placed by Erichson among the laparostict Scarabaeidæ, but in which, as Burmeister has shewn, the position of the abdominal stigmata ceases to be of value as a primary character. As a group of Melolonthidæ, this may be readily recognized by the labrum being at the end of the clypeus, and in the same plane; by the projecting mandibles, the wide parapleuræ, and the not connate six-jointed abdomen. The unguis are slender, equal and diverging. The only genus found in the United States is *Lichnanthe*, which differs from *Amphicoma* chiefly by the deeply emarginate labrum.

### LICHNANTHE Burm.

1. *L. vulpina*, nigra, thorace, scutello, pygidio pectoreque fulvo longissime pilosis, elytris æneo-testaceis punctatis, breviter nigro-pubescentibus, postice valde dehiscentibus. Long. .52—.67.

Burmeister, Lamell. 2, 27.

*Amphicoma vulpina* Hentz, Journ. Acad. Nat. Sc. Phila. 5, tab. 13, fig. 3.

Massachusetts and New Hampshire; Dr. T. W. Harris. The female is much less hairy, and has the club of the antennæ shorter and obtuse. The elytra diverge very strongly along the suture, and are obtusely rounded at tip.

2. *L. lupina*, obscure viridi-ænea, punctata, thorace elytrisq̃ æneo-piceis breviter pubescentibus, thoracis lateribus pectoreque longe haud dense cinereo-pilosis, elytris pallidioribus haud dehiscentibus, subtus cinereo-pilosa. Long. 36—43.

Sea shore near New York; not common. Found also in Pennsylvania and New Jersey. Much smaller than the preceding, and very distinct by the absence of the long yellow hair, and by the elytra meeting along the suture. The abdomen and the club of the antennæ are as in the preceding.

It is stated by Doubleday that he has seen specimens of this genus from Oregon; it is difficult to believe that either of the species here described have so extensive a range.



ART. XIX.—*Descriptions of Exotic Genera and species of the family UNIONIDÆ.*

By ISAAC LEA, LL. D.

UNIO HAINESIANUS. Pl. 21, fig. 1.

Testâ alatâ, lævi, subrotundatâ, subinflatâ, valdè inæquilaterali, valvulis crassis; natibus prominentibus, angularis; epidermide luteo-fuscâ; dentibus cardinalibus crassis, crenulatis elevatisque; lateralibus longis, crassis subcurvisque; margaritâ albâ et iridescente.

Shell winged, smooth, subrotund, somewhat inflated and very inequilateral; valves thick; beaks rather prominent and angular; epidermis yellowish brown; cardinal teeth thick, crenulate and elevated; lateral teeth long, thick and somewhat curved; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 92.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. 2·3, Length 4·5, Breadth 5·6 inches.

Shell winged behind, smooth, subrotund, rather inflated and very inequilateral, rounded before and behind; substance of the shell thick, thinner behind; beaks rather prominent, angular, and marked on the anterior portion with a line of small folds; ligament long, thick and concealed; epidermis yellowish brown, and apparently without rays; umbonial slope without any elevation: marks of growth very distant; cardinal teeth thick, crenulate, conical and double in both valves; lateral teeth long, thick, lamellar and somewhat curved, the bifid end short, and the area between this and the cardinal tooth smooth and arched; anterior cicatrices distinct and deeply impressed; posterior cicatrices confluent; dorsal cicatrices in a long row from the centre of the cavity of the beak; pallear cicatrix deeply impressed; cavity of the shell rather deep; cavity of the beaks shallow and angular; nacre white and iridescent.

*Remarks.*—There are two specimens only of this fine species among the shells from Mr. Haines, procured through Dr. House from Siam. I dedicate it to Mr. Haines with great pleasure. In outline it is close to *U. superbus*, (nobis,) but is more rotund. It is more shallow in the cavity, much thicker in the anterior portion, and in the teeth they differ much. The cardinal teeth of *U. superbus* are long and lamellar, while in *Hainesianus* they are short, thick and conical. The nacre is not so pearly in the latter. In outline and form of the teeth it approaches *Unio Paramensis*, (nobis,) also, but the lateral teeth are not so long, and the upper section of the double tooth

falls much shorter than the lower section. The beaks of both specimens are eroded, but there are marks observable along the anterior slope, which display a single row of an unusual form, but too indistinct to describe clearly.

UNIO MYERSIANUS. Pl. 22, fig. 2.

Testâ bialatâ, lævi, triangulari, subcompressâ, inæquilaterali, posticè angulatâ; valvulis crassis; natibus prominulis; epidermide tenebroso-fuscâ; dentibus cardinalibus longis crenulatisque; lateralibus prælongis, lamellatis subcurvisque; margaritâ colore salmonis tinctâ.

Shell with two wings, smooth, triangular, rather compressed, inequilateral, angular behind; valves thick; beaks somewhat prominent; epidermis dark brown; cardinal teeth long and crenulate; lateral teeth very long, lamellar and somewhat curved; nacre salmon colored.

Proc. Acad. Nat. Sci. Vol. 8, p. 92.

*Hab.*—Siam. S. R. House, M. D.

My cabinet, cabinet of W. A. Haines, New York, and Dr. Ingalls, Greenwich, N. Y.  
Diam. 1·6, Length 3·6, Breadth 5·6 inches.

Shell with two wings, connate before and behind, smooth, triangular, rather compressed, inequilateral, angular behind and rounded before; substance of the shell thick; beaks a little prominent; ligament long, large and concealed; epidermis dark brown, with two obscure lines passing from the beak to the posterior basal margin; umbonial slope obtusely angular; marks of growth distant and indistinct; cardinal teeth disposed to be double in both valves, but more so in the right, crenulate: lateral teeth very long, lamellar, somewhat curved and joined to the cardinal tooth: anterior cicatrices all three very distinct; posterior cicatrices very indistinctly marked, confluent; dorsal cicatrices deeply marked in the centre of the cavity of the beak; pal-leal cicatrix deeply impressed; cavity of the shell somewhat deep: cavity of the beaks rather shallow and subangular; nacre salmon colored and iridescent.

*Remarks.*—There is a very close resemblance between this and *Housei*, herein described, and they may possibly prove to be merely strong varieties when complete suites are obtained. There are some sixteen specimens of the two before me, and they can be separated by the crenulated cardinal teeth of *Myersianus*, which species is also larger and more ponderous. The oldest specimens have the teeth flatter and more crenulate. In some of the specimens the cicatrix of the superior anterior tractor muscle is separate from the other anterior cicatrix, and deeply impressed. Unfortunately not one of the specimens has a perfect wing before or behind, but there remains evidence of their being somewhat elevated. This is one of the fine shells procured by Mr. Haines from Bangkok, through the kindness of Mr. John K. Myers, of New York, after whom I name it.

## UNIO HOUSEI. Pl. 23, fig. 3.

Testâ bialatâ, lævi, triangulari, compressâ, valdè inæquilaterali, posticè obtusè angulatâ; valvulis subcrassis; natibus prominulis; epidermide fuscâ; dentibus cardinalibus lamellatis; lateralibus prælongis, lamellatis subcurvisque; margaritâ salmonis colore tinctâ.

Shell with two wings, smooth, triangular, compressed, very inequilateral, obtusely angular behind; valves rather thick; beaks somewhat prominent; epidermis brownish; cardinal teeth lamellar; lateral teeth very long, lamellar and somewhat curved; nacre salmon colored.

Proc. Acad. Nat. Sci. Vol. 8, p. 92.

*Hab.*—Siam. S. R. House, M. D.

My cabinet, cabinet of W. A. Haines, New York, and Dr. Ingalls, Greenwich, N. Y.  
Diam. 1·3, Length 3·8, Breadth 4·2 inches.

Shell with two wings, connate before and behind, smooth, triangular, compressed, very inequilateral, rounded before and obtusely angular behind; substance of the shell rather thick; beaks rather prominent, with a few very small undulations; ligament rather long and concealed; epidermis greenish brown with two lines in the posterior slope, obscurely rayed, smooth and shining; umbonial slope obtusely angular; marks of growth distant and indistinct; cardinal teeth long, lamellar, oblique and double in both valves, but more defined in the right; lateral teeth long, very lamellar, slightly curved and joined to the cardinal tooth; anterior cicatrices distinct, the larger one having a deep sinus on the superior part; posterior cicatrices very indistinctly marked, confluent; dorsal cicatrices well marked in the cavity of the beaks; cavity of the shell very shallow; cavity of the beaks very shallow and obtusely angular; nacre delicately salmon colored and iridescent.

*Remarks.*—This belongs to a natural group of symphynote species of which *U. delphinus* may be considered the type. It is, however, not so wide, nor has it so high a wing posteriorly. It differs also in the teeth, the cardinal teeth being more lamellar and divided into two or more parts, while those in the *delphinus* are flattened and crenulate or granose. The lamellar teeth of *delphinus* are nearly straight, or entirely so, while those of *Housei* are more or less curved. The specimens were all more or less injured, and particularly in the wings.

I owe this, with many other species from Siam, to the kindness of Mr. W. A. Haines, who obtained them from Dr. House, now a resident of the city of Bangkok, and to the latter gentleman I dedicate this fine species with pleasure.

## UNIO LUTEUS.\* Pl. 24, fig. 4.

Testâ lævi, ellipticâ, inflatâ, subæquilaterali, posticè obtusè angulatâ; valvulis crassis; natibus subprominentibus; epidermide luteâ, politâ; dentibus cardinalibus crassis brevisque; lateralibus brevis, subcrassis subrectisque, margaritâ albâ et iridescente.

\* This was printed, by typographical error, in the Proceedings, Vol. 8, p. 93, *lutens* instead of *luteus*.

Shell smooth, elliptical, inflated, nearly equilateral, obtusely angular behind; valve thick; beaks somewhat prominent; epidermis yellow, polished; cardinal teeth thick and short; lateral teeth short, rather thick and nearly straight; nacre white, iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Newville, Burmah. Mrs. Vinton.

Cabinet of Mr. W. A. Haines, New York.

Diam. .7, Length 1, Breadth 1.4 inch.

Shell smooth, elliptical, inflated, nearly equilateral, obtusely angular behind and rounded before; substance of the shell thick, thinner behind; beaks somewhat prominent, nearly medial; ligament rather short; epidermis olive yellow, smooth and polished; umbonial slope subangular; cardinal teeth large, thick and short; lateral teeth short, rather thick and nearly straight; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell rather deep and rounded; cavity of the beak rather shallow and angular; nacre white and iridescent.

*Remarks.*—A single specimen only of this species was received by Mr. Haines. In outline it is most like to *U. Tavoyensis*, Gould, but it differs in being without folds, being yellow and not so much inflated towards the beaks. It also resembles *U. corrugatus*, Retz., but is not corrugate, nor is it quite so transverse. It differs also in color. The tips of the beaks being eroded in this specimen, I am unable to say if there be any undulations there in perfect individuals.

#### UNIO GRAVIDUS. Pl. 24, fig. 5.

Testâ alâtâ, lævi, triangulari, valdè inflatâ, valdè inæquilaterali; valvulis tenuibus; natibus elevatis, tumidis; epidermide luteâ, nitidâ; dentibus cardinalibus prælongis, valdè lamellatis; lateralibus longis, lamellatis subcurvisque; margaritâ cæruleo-albâ et iridescente.

Shell winged, smooth, triangular, very much inflated, very inequilateral; valves thin; beaks elevated, swollen, epidermis yellowish, shining; cardinal teeth very long and very lamellar; lateral teeth long, lamellar and slightly curved; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. 1.9, Length 2.4, Breadth 3.2 inches.

Shell winged, smooth, triangular, very much inflated, very inequilateral; substance of the shell thin, thinner behind; beaks elevated, very much inflated and undulate at the tip, in a double row with small striæ on each side; ligament rather long and thin; epidermis yellowish, inclined to olive, shining, with three obscure rays on the

posterior slope; cardinal teeth very long, lamellar, *double* in the right and *single* in the left valve; lateral teeth long, lamellar and slightly curved; anterior cicatrices confluent; posterior cicatrices confluent; dorsal cicatrices concealed within the cavity of the beaks; cavity of the shell large, deep and rounded; cavity of the beaks very deep and rounded; nacre bluish white and iridescent.

*Remarks.*—This species has a close resemblance to *U. superbus* (nobis) from New Holland. It may be distinguished from it by the *gravidus* being more inflated, by its yellow epidermis and bluish white nacre. The *superbus* is a thicker shell, and the teeth are less lamellar and the cardinal teeth are rather shorter. All I have seen are delicately salmon colored, while the ten or twelve specimens of *gravidus* before me are all white. The greater transverse diameter is much nearer the centre of the shell, and the outline approaches more to the rotund. The three rays on the posterior slope are very distinct and beautiful in the young specimens. The lunule is in several of the specimens remarkably large. The cardinal teeth in right valve are disposed to curve upwards.

Mr. Haines received this species, with many interesting ones, from Dr. House, of Bangkok, Siam.

#### UNIO INORNATUS. Pl. 24, fig. 6.

Testâ lævi, ellipticâ, inflatâ, subæquilaterali, posticè subangulatâ; valvulis subpellucidis tenuibusque; natibus subprominentibus; epidermide olivaceâ, substriatâ; dentibus cardinalibus longis lamellatisque; laterali-bus longis, rectis lamellatisque; margaritâ cæruleo-albâ et iridescente.

Shell smooth, elliptical, inflated, nearly equilateral, subangular behind; valves subpellucid and thin; beaks a little prominent, epidermis olive, substriate; cardinal teeth long and lamellar; lateral teeth long, straight and lamellar; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. .7,                                      Length 1,                                      Breadth 1.8 inch.

Shell smooth, elliptical, inflated, nearly equilateral, subangular behind; substance of the shell subpellucid and thin; beaks a little prominent, submedial; ligament long and thin; epidermis olive colored with minute striæ and having three obscure rays on the posterior slope; umbonial slope rounded; cardinal teeth long, bladed and straight; lateral teeth long, straight, bladed and very thin; anterior cicatrices confluent and but very slightly impressed; posterior cicatrices scarcely perceptible; dorsal cicatrices imperceptible; cavity of the shell deep and rounded; cavity of the beaks very small and subangular; nacre bluish white and iridescent.

*Remarks.*—Among the shells from Siam, submitted to me by Mr. Haines, were nine

specimens of this species. It is not remarkable for any peculiar characters. In outline it closely approaches *H. cœruleus*, (nobis,) but it differs in not having a bluish epidermis, in being more transverse, and in not possessing the fine undulations of the beaks and the posterior slope. Neither of the specimens are entirely perfect at the tips of the beaks, but I cannot perceive any indication of undulations.

UNIO RUSTICUS. Pl. 25, fig. 7.

Testâ tuberculatâ, ellipticâ, inflatâ, inæquilaterali, posticè subangulatâ; valvulis subcrassis; natibus subprominentibus; epidermide olivaceâ, substriatâ; dentibus cardinalibus longis lamellatisque; lateralibus longis, lamellatis subrectisque; margaritâ albâ et iridescente.

Shell tuberculate, elliptical, inflated, inæquilateral, subangular behind; valves rather thick; beaks somewhat prominent; epidermis olive color, somewhat striate; cardinal teeth long and lamellar; lateral teeth long, lamellar and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. 1.1, Length 1.4, Breadth 2.3 inches.

Shell tuberculate, elliptical, inflated, inequilateral, subangular behind and rounded before; substance of the shell rather thick; beaks somewhat prominent, granulate; ligament rather short and somewhat thick; epidermis olive colored, with three green rays on the posterior slope; umbonial slope subangular; cardinal teeth long and lamellar, double in the *right* and single in the *left* valve; lateral teeth long, lamellar and nearly straight; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed under the cardinal tooth; cavity of the shell large and rounded; cavity of the beaks deep and subangular; nacre white and iridescent.

*Remarks.*—There were about a dozen of this species submitted to my examination by Mr. Haines, differing very much from each other. Some of them are tuberculate nearly over the whole surface, while others are almost entirely without tubercles. In this it agrees with *U. corrugatus*, Retz, and *U. Tavoyensis*, Gould. In outline it closely approaches *U. Javanus*, (nobis,) but is a rougher shell and the folds on the posterior slope are coarser. In some specimens the tubercles about the beaks resemble those of *U. Murchisonianus*, (nobis.)

UNIO EXIMIUS. Pl. 25, fig. 8.

Testâ alatâ, plicatâ, obovatâ, compressâ, valdè inæquilaterali, posticè rotundatâ; valvulis tenuissimis; natibus prominulis; epidermide virido-luteâ, obsoletè radiatâ; dentibus cardinalibus lamellatis tenuibusque; lateralibus longis, lamellatis subcurvisque; margaritâ cœruleo-albâ et iridescente.

Shell winged, plicate, obovate, compressed, very inequilateral, rounded behind;

valves very thin; beaks slightly prominent; epidermis greenish yellow, obsoletely radiated; cardinal teeth lamellar and thin; lateral teeth long, lamellar and slightly curved; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. .5, Length 1.6, Breadth 2 inches.

Shell winged, with numerous small folds over the beaks and posterior slope, obovate, compressed, very inequilateral, rounded and compressed behind; substance of the shell very thin and delicate: beaks slightly prominent and minutely undulate; ligament long and very thin; epidermis greenish yellow with three very distinct rays over the posterior slope; cardinal teeth lamellar, *double* in the right and *single* in the left valve: lateral teeth long, lamellar and slightly curved, *treble* in the left and *double* in the right valve; anterior cicatrices confluent and slightly impressed; posterior cicatrices apparently none; dorsal cicatrices placed in the centre of the beaks; cavity of the shell very shallow; cavity of the beaks shallow, angular; nacre bluish white and iridescent.

*Remarks.*—In outline and general appearance this interesting species resembles the young of *Unio alatus*, Say. It may at once be recognised to be different by the numerous small folds—which are visible in the interior as well as the exterior—as well also by the peculiar number and place of the lateral and cardinal teeth. It would naturally follow, as a plicate shell, *U. Nicklinianus*, (nobis.) The most remarkable feature in this species is the possession of *three lateral teeth* in the left valve. In the eight specimens before me the three teeth are recognised. In all of them the upper division is smaller than the two lower ones, and the upper one of the two of the right valve is also always smaller. The cardinal teeth are remarkable for being double in the *right* and single in the *left* valve. Some of the specimeus are enlarged over the umbonial slope, immediately behind which there is a slight emargination at base. The enlargement is owing probably to sexual difference.

#### UNIO TUMIDULUS. Pl. 25, fig. 9.

Testâ lævi, obliquâ, inflatâ, posticè angulatâ, valdè inæquilaterali; valvulis suberassis; natibus prominentibus; epidermide tenebroso-olivaceâ, striatâ; dentibus cardinalibus longis lamellatisque; lateralibus prælongis subcurvisque; margaritâ albâ et iridescente.

Shell smooth, oblique, inflated, angular behind, very inequilateral; valves rather thick; beaks prominent; epidermis dark olive, striate; cardinal teeth long and lamellar; lateral teeth very long and somewhat curved; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. .8, Length 1.1, Breadth 2 inches.



Shell smooth, oblique, inflated, angular behind and rounded before, very inequilateral; substance of the shell rather thick, thinner behind; beaks prominent, minutely folded; ligament rather long and somewhat thick; epidermis dark olive, striate, with three green rays on the posterior slope; umbonial slope subangular; cardinal teeth long and lamellar, double in the *right* and single in the *left* valve; lateral teeth very long and somewhat curved; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed on the posterior inferior portion of the cardinal tooth; cavity of the shell deep and rounded; cavity of the beaks rather shallow and subtriangular; nacre white and iridescent.

*Remarks.*—One specimen and a single valve were all which came with the shells from Dr. House. In outline and general appearance it approaches *U. Tigris*, Fer., from Bagdad. But it is a larger species, not of so fine a polish, and the cardinal teeth are longer and more lamellar. In outline it also has some affinity to *U. rusticus*, herein described, but it differs in being more oblique and being without tubercles.

UNIO HUMILIS. Pl. 26, fig. 10.

Testâ plicatâ, transversâ, subinflatâ, subæquilaterali, subcylindraceâ, posticè biangulatâ; valvulis tenuibus, pellucidis; natibus prominulis, perplicatis; epidermide virido-luteâ, striatâ; dentibus cardinalibus lamellatis rectisque; lateralibus longis lamellatisque; margaritâ cæruleo-albâ et iridescente.

Shell plicate, transverse, somewhat inflated, subcylindrical, nearly equilateral, biangular behind; valves thin, transparent; beaks somewhat prominent and much plicate; epidermis greenish yellow, striate; cardinal teeth lamellar and straight; lateral teeth long and lamellar; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. .4, Length .5, Breadth 1 inch.

Shell folded, wide, somewhat inflated, subcylindrical, nearly equilateral, biangular behind; substance of the shell thin, transparent; beaks somewhat prominent, sub-medial, much folded at the tips; ligament rather short and thin; epidermis greenish yellow, the green predominating on the folds, striate; umbonial slope subangular; cardinal teeth lamellar and straight, double in the *right* and single in the *left* valve; lateral teeth long, lamellar, straight, double in the left and single in the right valve; anterior cicatrices confluent; posterior cicatrices confluent, scarcely perceptible; dorsal cicatrices invisible; cavity of the shell rather deep; cavity of the beaks shallow and subangular; nacre bluish white and very iridescent.

*Remarks.*—There are eight specimens of this small species of various ages before me, the largest of which is not an inch wide. In its general phase it resembles *U. crispatus*, Gould, but differs in being a smaller species, much thinner and having fewer

folds. In the *crispatus* the folds cover the whole surface. In our shell they are smaller and extend over the upper part only of the valve, and down the posterior slope. In the teeth they are quite different; those of the *crispatus* being thicker and the *cardinal* teeth being shorter and double in *both valves*. The folds are small and numerous, and may be seen on the inside of the valves in the region of the beaks and the posterior slope. The size of *humilis* is about that of *U. acutissimus*, (nobis,) but is not so angular on the posterior margin, and the folds are smaller and more numerous. It differs also in color, the *acutissimus* being more yellow.

## UNIO PHASELUS. Pl. 26, fig. 11.

Testâ plicatâ, transversâ, inflatâ, submarginatâ, valdè inæquilaterali, posticè obtusè angulatâ; valvulis crassis; natibus parvis, prominulis, ad apicem undulatus; epidermide viridi et luteâ, politâ; dentibus cardinalibus brevis suberassisque; lateralibus prælongis, in utroque valvulo duplicibus subcurvisque; margaritâ albâ et iridescente.

Shell plicate, transverse, inflated, submarginate, very inequilateral, obtusely angular behind; valves thick; beaks small and somewhat prominent, folded on the apex; epidermis green and yellow, polished; cardinal teeth short and somewhat thick; lateral teeth very long, double in both valves and somewhat curved; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. .5,

Length .5,

Breadth 1.1 inch.

Shell folded, wide, inflated, submarginate at base, very inequilateral, obtusely angular behind; substance of the shell thick; beaks small, a little prominent, folded on the apex; folds small, few, green, extending over the superior portion and on the posterior slope; ligament rather short and thin; epidermis rather a light yellow, highly polished, with a few transverse green lines, some of which are disposed to take a zigzag form; umbonial slope rounded; cardinal teeth short, rather thick and disposed to be double in both valves; lateral teeth very long, somewhat curved and *double in both valves*; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed on the under posterior part of the cardinal tooth; cavity of the shell deep; cavity of the beak rather shallow and rounded; nacre white and very iridescent.

*Remarks.*—This species belongs to a group in which may be included *gratiosus*, Phil., *crispatus*, Gould, *humilis* and *nucleus* herein described. In outline it very much assimilates to *crispatus*, but it differs very much in having few folds, in being highly polished, less angular at the posterior margin, and more rounded and inflated on the posterior slope. The younger specimens have a strong resemblance to *humilis*, but are more polished, have fewer folds and are thicker. On the umbonial slope near the

apex, there are three or four granules in a line. There are five specimens before me; two adult, both of which I suspect are females, and three about half grown. The general form and emargination of the base, give it very much the appearance of a horse bean, whence the name.

UNIO SAGITTARIUS. Pl. 26, fig. 12.

Testâ lævi, valdè transversâ, valdè inæquilaterali, subinflatâ, subcylindraceâ, posticè acuto-angulatâ; valvulis subtenuibus; natibus vix prominentibus; epidermide virido-olivaceâ, striatâ; dentibus cardinalibus longis, rectis lamellatisque; lateralibus prælongis subrectisque; margaritâ albâ et iridescente.

Shell smooth, very transverse, very inequilateral, rather inflated, rather cylindrical, acutely angular behind; valves rather thin; beaks scarcely prominent; epidermis greenish olive, striate; cardinal teeth long, straight and lamellar; lateral teeth very long and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet and cabinet of W. A. Haines, New York.

Diam. .6, Length .8, Breadth 2 inches.

Shell smooth, very transverse, very inequilateral, rather inflated, rather cylindrical, acutely angular behind; substance of the shell rather thin; beaks scarcely prominent, nearly terminal: ligament very long and thin; epidermis olive green, darker on the posterior portion, striate and without rays; umbonial slope subangular; cardinal teeth long, straight, lamellar, double in the *right* and single in the *left* valve; lateral teeth very long, nearly straight, single in the right and double in the left valve; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed in the centre of the cavity of the beaks; cavity of the shell rather deep and rounded; cavity of the beaks scarcely perceptible; nacre white and iridescent.

*Remarks.*—There were two specimens and an odd valve only of this species among the Siamese shells brought by Dr. House. In general form and characteristics, it is exceedingly like *U. Cailliaudii*, Fer., from Egypt, and might at first sight be taken for that species. It is, however, entirely different in the cardinal teeth as to form, size and condition. Our shell has lamellar teeth, double in the right and single in the left valve, while the *Cailliaudii* has short, thick teeth, *double in both valves*. Both my specimens of *Cailliaudii* have minute rays over the whole disk, while *sagittarius* seems to be entirely without them. It must be remarked, however, that the specimens are by no means perfect. Neither of them have the beaks perfect enough to ascertain if they have been plicate. In outline this species has also some affinity to *U. Ingallsianus*, (nobis,) but it is much more transverse and more cylindrical.

## UNIO SCOBINATUS. Pl. 26, fig. 13.

Testâ plicatâ, transversâ, in medio compressâ, valdè inæquilaterali, posticè angulatâ, ad basim emarginatâ; valvulis subcrassis; natibus parvis, prominulis, ad apicem undulatis; epidermide viridi et luteâ, minutè striatâ; dentibus cardinalibus obliquis, compressis; lateralibus prælongis, in utroque valvulo duplicibus subrectisque; margaritâ albâ et iridescente.

Shell plicate, transverse, compressed in the middle, very inequilateral, angular behind, emarginate at base; valves rather thick; beaks small, somewhat prominent, undulate at the tip; epidermis green and yellow, minutely striate; cardinal teeth oblique, compressed; lateral teeth very long, double in both valves and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. T. R. Ingalls, M. D.; S. R. House, M. D.

My cabinet, cabinet of Dr. Ingalls and W. A. Haines.

Diam. .5,

Length .6,

Breadth 1.3 inch.

Shell folded, transverse, compressed in the middle, very inequilateral, angular behind, emarginate at base; substance of the shell rather thick; beaks small, a little prominent, undulate at tip; folds green, beautifully arranged over the whole disk, acutely angular over the middle, on the umbonial slope enlarging from the beaks to the posterior margin, where they are nearly parallel; ligament short and thin; epidermis yellow, the raised folds being always green, transversely and minutely striate; umbonial slope subangular; cardinal teeth oblique, short, crenulate, *double in both valves*; lateral teeth very long, *double in both valves*, enlarged at the posterior end and nearly straight; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed on the under side of the plate, posterior to the cardinal tooth; cavity of the shell shallow; cavity of the beak rather shallow and subangular; nacre white and iridescent.

*Remarks.*—This very beautiful Siamese little species was first sent to me by Dr. Ingalls, of Greenwich, N. Y. Several specimens of different sizes have since been put into my possession by Mr. Haines, to whom I am indebted for so many new species from this part of Asia. On receipt of Dr. Ingalls' specimens I had some doubts of their being a variety only of Dr. Gould's *crispatus*, but this doubt was dispelled on receipt of Mr. Haines' specimens. It belongs to that group of which *gratiosus*, Phil., may be considered the type. It certainly is nearest allied to *crispatus*, but may be distinguished by its being smaller, more transverse, having larger folds, and these thickly covering the whole disk, except on the last growth of old individuals; also in being compressed over the middle, and emarginate at base and in the duplex form of the lateral teeth. The *crispatus* is disposed to be yellowish in the cavity of the beaks, while *scobinatus* is pearly white. In outline *scobinatus* approaches *phaselus* herein described, which is rather smaller, and is a polished shell with few folds. They both have the duplex

lateral tooth in both valves. Like *nucleus* herein described the transverse close striae are very remarkable, and in both, the folds are beautifully developed on the inside. In some specimens the striae are nearly obliterated.

UNIO SUBTRIATUS. Pl. 26, fig. 14.

Testâ lævi, ellipticâ, subinflâtâ, subæquilaterali, posticê angulatâ, anticê rotundatâ; valvulis crassiusculis; natibus subprominentibus granulatisque; epidermide olivaceâ eradiatâ et rugoso-striatâ; dentibus cardinalibus longis, rectis lamellatisque; lateralibus longis, rectis lamellatisque; margaritâ argenteâ et iridescente.

Shell smooth, elliptical, subinflated, nearly equilateral, angular behind, surrounded before; valves rather thick; beaks a little prominent and granulated; epidermis olive colored, rayless and rugosely striate; cardinal teeth long, straight and lamellar; lateral teeth long, straight and lamellar; nacre silvery and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 93.

*Hab.*—Siam. S. R. House, M. D.

My cabinet. Cabinet of W. A. Haines, New York.

Diam. .4.

Length .5.

Breadth 1.1 inch.

Shell smooth, elliptical, somewhat inflated, nearly equilateral, angular behind and rounded before; slightly constricted from the beaks to the basal margin; substance of the shell rather thick; beaks a little prominent, with a few small granules at the top; ligament rather long and thin; epidermis olive colored, rayless, minutely and rugosely striate; posterior slope with two raised lines, and one impressed one nearest to the margin; umbonial slope rounded; cardinal teeth long straight and lamellar, double in the *right* and single in the *left* valve; lateral teeth long, straight and lamellar, double in the left and single in the right valve; anterior cicatrices confluent; posterior cicatrices scarcely perceptible; dorsal cicatrices imperceptible; cavity of the shell rather deep and rounded; cavity of the beaks angular and shallow; nacre silvery white and iridescent.

*Remarks.*—Two opposed valves of nearly the same size were all which Mr. Haines received among his Siamese shells. In form and general character this species is nearly allied to *U. inornatus* herein described. It differs in being a little more transverse, and in being thicker and smaller. It resembles in outline *U. cæruleus*, (nobis,) but has no bluish tint in the epidermis, and is entirely without rays, and is smaller. It is a very small species, not larger than a middle sized *U. parvus*, Barnes. It might be mistaken for a young *U. Ingallsianus*, (nobis,) but that shell is more oblique and smoother, and differs in the color of the posterior slope.

UNIO AFRICANUS. Pl. 27, fig. 15.

Testâ lævi, ellipticâ, subcompressâ, subemarginatâ, valdè inæquilaterali, posticê obtusè angulatâ; valvulis subtenuibus; natibus parvis, prominulis undulatisque; epidermide luteo-olivaceâ et politâ; dentibus

cardinalibus parvis, obliquis, compressis sublamellatisque; lateralibus prælongis subrectisque; margaritâ salmonis colore tinctâ et valdè iridescente.

Shell smooth, elliptical, subcompressed, subemarginate, very inequilateral, obtusely angular behind; valves rather thin, beaks small, somewhat prominent and undulate; epidermis yellowish olive and polished; cardinal teeth small, oblique, compressed and somewhat lamellar; lateral teeth very long and nearly straight; nacre salmon colored and very iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Cape of Good Hope. Mr. E. Verreaux.

My cabinet and cabinet of Mr. Verreaux, Paris, and W. A. Haines, New York.

Diam. .6. Length .8, Breadth 1.7 inch.

Shell smooth, elliptical, subcompressed, slightly emarginate at base, very inequilateral, obtusely angular behind; substance of the shell rather thin, thicker before; beaks small, somewhat prominent, with numerous small undulations at the tips and on the posterior slope; lines of growth few, distinct and distant; ligament rather long and slender; epidermis yellowish olive, very smooth and shining; umbonial slope subangular; cardinal teeth small, oblique, compressed, somewhat lamellar, double in both valves; lateral teeth very long, very slightly curved, single in the right and double in the left valve; anterior cicatrices distinct; posterior cicatrices distinct; dorsal cicatrices placed on the under posterior part of the cardinal teeth; cavity of the shell rather shallow; cavity of the beak rather shallow and subangular; nacre light salmon colored and very iridescent.

*Remarks.*—This species was procured by Mr. E. Verreaux while in South Africa, and given to me while in Paris, in 1853. Subsequently Mr. Haines submitted specimens to me from the same habitat. The anterior muscular cicatrices present an unusual character in the three, being remarkably distinct. The undulations of the beaks are beautifully distinct, numerous and regular, and are delicately arranged also on the posterior slope as well as over a large portion of the beaks. In outline and general character it is allied to *U. Batavus*, Lam., and more particularly to that variety named *U. Carynthiacus* by Ziegler. In outline and general form *Africanus* approaches *Verreauianus*, herein described, but it differs entirely in size and in the surface, being smooth and polished, while *Verreauianus* belongs to the *sulcate* division, and is usually twice the size; they therefore cannot be confounded. It approaches also to *U. Caffer*, Krauss, but differs much from the figure given by him, (*Sudafrik Moll.*, p. 18.) It much more resembles a specimen given to me by the late Prof. E. Forbes, from South Africa under that name.

UNIO VERREAUIANUS. Pl. 27, fig. 16.

Testâ sulcatâ, oblongâ, inflatâ, subemarginatâ, subæquilateralî, posticè obtusè angulatâ; valvulis crassis; natibus parvis, subprominentibus undulatisque; epidermidè luteo-brunnèâ, striatâ; dentibus cardinalibus

magnis, obliquis, compressis crenulatisque; lateralibus longis, rectis lamellatisque; margaritâ salmonis colore tinctâ et iridescente.

Shell sulcate, oblong, inflated, subemarginate, nearly equilateral, obtusely angular behind; valves thick; beaks small, a little prominent and undulate; epidermis yellowish brown, striate; cardinal teeth large, oblique, compressed and crenulate; lateral teeth long, straight and lamellar; nacre salmon colored and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Cape of Good Hope. Mr. E. Verreaux.

My cabinet, cabinets of Mr. Verreaux, Paris, and W. A. Haines, New York.

Diam. 1, Length 1.4, Breadth 2.5 inches.

Shell furrowed, oblong, inflated, slightly emarginate at base, nearly equilateral, obtusely angular behind; substance of the shell thick, thinner behind; beaks small, a little prominent, with numerous small undulations at tip; furrows transverse, rather close, irregular and covering nearly the whole disk; lines of growth distant and very distinct; ligament rather long and somewhat thick; epidermis yellowish in the younger specimens, but dark brown in the older ones; umbonial slope subangular; cardinal teeth large, oblique, compressed, crenulate, double in both valves; lateral teeth long, straight, lamellar, single in the right and double in the left valve; anterior cicatrices distinct; posterior cicatrices distinct; dorsal cicatrices placed on the under posterior part of the cardinal teeth; cavity of the shell deep and rounded; cavity of beak rather deep and subangular; nacre light salmon colored and iridescent.

*Remarks.*—I owe the possession of several specimens of this interesting species to Mr. Verreaux, naturalist, of Paris, whose researches for many years in South Africa, &c., has added so much to various branches of natural history. It belongs to that group which I have called *sulcate*, from the transverse furrows which exist in the substance of the exterior of the shell. It is not so sulcate as *Scamnatus*, Morelet, nor is it so much compressed. In outline and general form, it is nearly allied to *U. confertus*, (nobis,) but is not so ventricose as that species, nor is it so angular behind. It cannot be confounded with *U. Caffer*, Krauss, as that species is much smaller, more compressed, the form more elliptical, the teeth more tuberculose and the nacre purple.

I dedicate the species to that persevering traveller, Mr. Edward Verreaux.

#### UNIO SHURTLEFFIANUS. Pl. 27, fig. 17.

Testâ minutè plicatâ, ellipticâ, inæquilaterali, subcylindraceâ, posticè obtusè angulatâ, anticè rotundatâ, ad latus subplanulatâ; valvulis suberassis; natibus prominulis, ad apices minutè undulatis; epidermide virido-luteâ; dentibus cardinalibus sublongis, compressis geminisque; lateralibus longis subrectisque; margaritâ salmonis colore tinctâ et iridescente.

Shell minutely folded, elliptical, inequilateral, somewhat cylindrical, obtusely angular behind, rounded before and slightly flattened at the sides; valves somewhat thick; beaks a little prominent and minutely undulated at tip; epidermis greenish



yellow; cardinal teeth rather long, compressed and double; lateral teeth long and nearly straight; nacre salmon colored and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Sina River, India. Major Le Conte; Ahmednugger, India, S. Shurtleff, M. D.

My cabinet, cabinets of Major Le Conte, Dr. Shurtleff and Dr. Ingalls.

Diam. .6,

Length .7,

Breadth 1.6 inch.

Shell minutely folded, elliptical, inequilateral, somewhat cylindrical, obtusely angular behind, regularly rounded before and slightly flattened at the sides; substance of the shell somewhat thick, thinner behind; beaks a little prominent, pointed and minutely undulate at tip; posterior slope raised into a small carina, and covered with very delicate small undulations, and furnished with two indistinct lines from the beak to posterior margin; ligament rather short and thin; epidermis greenish yellow, with obscure green rays; umbonial slope rounded; cardinal teeth rather long, compressed and double in both valves; lateral teeth long and nearly straight, single in the right and double in the left valve; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed within the cavity of the beaks and on the under side of the posterior portion of the cardinal tooth; cavity of the shell rather deep; cavity of the beaks shallow and subangular; nacre slightly salmon colored and iridescent.

*Remarks.*—Several specimens of this shell are before me. Two of them are odd, young valves. The specimen figured has been in my possession some years, but being very closely allied to *U. graciosus*, Phil., I feared it might prove a variety only of that species. The young specimens and other adults since received, satisfy me that they are distinct. The specimens of *graciosus* which I have in my cabinet are much less transverse and much smaller. They are precisely the same in outline and folds with Dr. Philippi's figure, (Conchylien, v. 1, t. 1, f. 5.) The *Shurtleffianus* is more cylindrical and the basal margin is disposed to be emarginate. The folds are beautifully disposed over the upper part of the disk up to the tip of the beaks. They are remarkably minute, and so divergent and re-entering, as to make zigzag lines. In outline and size the *Shurtleffianus* is very near to *cæruleus*, (nobis,) also from India, but it may easily be distinguished from that species by being devoid of that bluish color, by the posterior margin being less angular, by the beaks being more medial and the nacre being salmon colored. The teeth are also less lamellar and the folds more numerous. It differs from *crispatus*, Gould, in having coarser folds, in color of nacre, as well as in having the teeth more lamellar, and the posterior margin being less acute.

I have dedicated this species to Dr. Shurtleff, to whose kindness I owe specimens of several ages.

#### UNIO EFFULGENS. Pl. 28, fig. 18.

Testâ sulcatâ, ellipticâ, subinflatâ, inæquilateralî, posticè obtusè angulatâ; valvulis subcrassis; natibus

prominulis; epidermide tenebroso-fuscâ, politâ; dentibus cardinalibus parvis crenulatisque; lateralibus longis curvisque; margaritâ cæruleo-albâ.

Shell furrowed, elliptical, rather inflated, inequilateral, obtusely angular behind; valves rather thick; beaks a little prominent; epidermis dark brown and polished; cardinal teeth small and crenulate; lateral teeth long and curved; nacre bluish white.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Brazil. B. W. Budd, M. D.

Cabinet of Dr. Budd, New York.

Diam. .7,

Length 1.2,

Breadth 2 inches.

Shell transversely furrowed, elliptical, rather inflated, inequilateral, obtusely angular behind and regularly rounded before; substance of the shell rather thick, thicker before; beaks a little prominent; ligament thin and rather short; epidermis dark chestnut brown, highly polished, apparently without rays; umbonial slope rounded and but slightly elevated; cardinal teeth small, slightly compressed and crenulate; lateral teeth long, rather thin and curved; the two inferior anterior cicatrices confluent, the superior one distinct; posterior cicatrices confluent, dorsal cicatrices placed in the cavity of the beaks; cavity of the shell shallow; cavity of the beaks very shallow and rounded; nacre bluish white.

*Remarks.*—A single specimen of this species only was submitted to me by Dr. Budd, but it differs so much from any described shell I am acquainted with that I have not hesitated to give it a name. In general aspect it resembles *U. ellipticus*, (*Diplodon ellipticum*, Spix), but it is not transverse, seems to be without folds and has more marked transverse striæ; the lateral teeth are more curved and the epidermis is more highly polished. The beaks of the specimen above described are eroded, and more perfect ones may be found to have undulations at the tips.

#### UNIO SHUTTLEWORTHII. Pl. 28, fig. 19.

Testâ sulcatâ, oblongâ, transversâ, valdè inæquilateralî, subcompressâ, posticè obtusè biangulatâ, ad latus planulatâ; valvulis suberassis; natibus prominulis; epidermide brunneo-nigricante; dentibus cardinalibus parvis; lateralibus longis subcurvisque; margaritâ purpureâ et iridescente.

Shell sulcate, oblong, transverse, very inequilateral, rather compressed, obtusely biangular behind, flattened on the sides; valves rather thick; beaks a little prominent; epidermis blackish brown; cardinal teeth small; lateral teeth long and slightly curved; nacre purple and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Australia. R. J. Shuttleworth, Berne, Switzerland.

My cabinet, cabinets of Mr. Shuttleworth, W. A. Haines, New York, and H. Cuming, London.

Diam. 1.1,

Length 2,

Breadth 4 inches.

Shell sulcate, oblong, transverse, very inequilateral, rather compressed, obtusely

biangular behind, flattened on the sides; substance of the shell rather thick; beaks a little prominent and placed towards the anterior margin; posterior slope raised into a carina; ligament thin, long and nearly straight; epidermis blackish brown, shining on the umbonial slope; furrows deep on the anterior portion, nearly obsolete on the umbonial slope; umbonial slope rounded and but slightly raised; cardinal teeth very small, in the left valve single, triangular and elevated into a sharp point, in the right valve double, the superior division being very small; lateral teeth very long, lamellar, and but slightly curved; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices consist of a long row from the smaller anterior cicatrix across the interior cavity to the under part of the lateral tooth; cavity of the shell rather shallow; cavity of the beaks small, subangular; nacre purple and iridescent.

*Remarks.*—But a single specimen of this shell is before me; interesting from the fact, as an Australian species, it should so closely resemble an American one, as, at first sight, it might be considered to be merely a variety. It has very nearly the exact outline of *Hopetonensis*, (nobis,) from Georgia, and is nearly of the same color in the epidermis. It differs in having transverse furrows nearly over the whole disk, which in the Georgian are but slightly developed. It has smaller teeth, and in the left valve the cardinal tooth is single, in the right scarcely bifid. The color of the nacre of the specimen before me is of a darker purple than any of the Georgian species which I have seen. The color of the nacre may differ in other specimens, as it does in the *Hopetonensis*, which is sometimes white and sometimes slightly salmon colored. The beaks of the specimen of *Shuttleworthii* before me are eroded, and therefore it is impossible to say if they be undulate; but I suspect that in perfect specimens they will be found to be so, as on the posterior slope very indistinct undulations may be perceived, decussating an obscure furrow running from the beaks to the posterior margin. If in other specimens these folds are found more numerous and more pronounced, then we ought to remove the species from the furrowed to the plicate group. The carina is so much elevated that it might almost be considered to belong to the alate division.

UNIO DUNKERIANUS. Pl. 28, fig. 20.

Testâ plicatâ, transversâ, subinflatâ, valdè inæquilaterali, posticè obtusè angulatâ; valvulis subtenuibus; natibus prominulis, costis divaricatis; epidermide tenebroso-fuscâ politâque; dentibus cardinalibus longis compressisque; lateralibus prælongis, lamellatis rectisque; margaritâ cæruleo-albâ et valdè iridescente.

Shell folded, transverse, somewhat inflated, very inequilateral, obtusely angular behind; valves rather thin; beaks with diverging ribs; epidermis blackish brown and polished; cardinal teeth long and compressed; lateral teeth very long, lamellar and straight; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

Shell folded, quadrate, inflated, nearly equilateral, angular behind; substance of the shell thick, but shewing the undulations within; beaks rather prominent, sub-

medial and covered with folds; ligament very short and rather thick; epidermis greenish brown, the folds being usually green, minutely striate over the whole disk; umbonial slope high and angular; cardinal teeth thick, short and much divided; lateral teeth thick, short, somewhat curved, *double in both valves* and enlarged at the posterior end; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed on the underside of the posterior portion of the cardinal teeth; cavity of the shell rather deep; cavity of the beaks rather deep and angular; nacre bluish white and iridescent.

*Remarks.*—This species is very remarkable for its diminutive size. There were only two specimens submitted to me by Mr. Haines, and I believe they are all he received. They are nearly of the same size; and if they be of normal dimensions, the species is certainly the smallest I am acquainted with. It is nearest to *U. crispatus*, Gould, in general appearance, being covered over with nearly the same kind of folds, which are green like *crispatus*. In outline, however, it differs very much as well as in size, not being more than one-third the breadth. The umbonial slope is also much more angular. It might be suspected that it had been mistaken for a young *crispatus*, but on comparison with a young *crispatus* before me, I find it flatter, less robust, with smaller folds and more yellow. The minute striæ over the disk are close and lamellate, and are of a brownish color. The folds over the whole disk are strongly marked, are green and disposed to run into angles, while the intermediate spaces are yellowish. On the inside the folds are distinctly visible.

UNIO BROWNI. Pl. 29, fig. 22.

Testâ lævi, obovatâ, valdè compressâ, valdè inæquilaterali; valvulis subcrassis; natibus prominulis, costis divaricatis; epidermide tenebroso-viridi, striatâ; dentibus cardinalibus submagnis, in utroque valvulo duplicibus; lateralibus lamellatis, sublongis curvisque; margaritâ albâ.

Shell smooth, obovate, very much compressed, very inequilateral; valves rather thick; beaks but little prominent, ribbed at the apex; epidermis dark green, striate; cardinal teeth rather large, double in both valves; lateral teeth lamellar, rather long and curved; nacre white.

Proc. Acad. Nat. Sci. Vol. 8, p. 95.

*Hab.*—Mocha? Asia. Capt. George Brown.

My cabinet.

Diam. .4,

Length .7,

Breadth 1.1 inch.

Shell smooth, obovate, very much compressed, very inequilateral, elevated on the posterior slope almost into a wing; substance of the shell rather thick, thinner behind; beaks but a little prominent, with rather short divergent ribs at the apex; ligament short and very thin; epidermis dark green, striate; umbonial slope rounded and very slightly raised; cardinal teeth rather large, oblique, compressed, crenulate

and double in both valves; lateral teeth lamellar, rather long, curved, single in the right and double in the left valve, thickened towards the posterior end; the two inferior anterior cicatrices confluent, the superior one distinct; posterior cicatrices confluent; dorsal cicatrices placed in a row across the cavity of the beaks; cavity of the shell very shallow; cavity of the beaks very shallow and subangular; nacre white.

*Remarks.*—The specimen above described is probably quite a young one, and I have great doubt of its really being a native of Arabia. Among many fine shells brought by Captain Brown, from nearly all parts of the world where he carried on his commercial affairs, were many rare and fine specimens from the rivers of South America. This specimen was marked in one valve "Mocha;" in the other, "Red Sea;" so that he most probably purchased it in Arabia; and still it may have been brought there by trading vessels from South America, having some of the characters of that habitat, particularly the diverging costæ on the beaks; which character so peculiarly belongs to most of the species of that quarter of the globe. It seems to be more nearly allied to *U. Paranensis*, (nobis,) than to any species I am acquainted with, but it is not so rotund, nor is it so much inflated along the umbonial slope. The costæ of the beaks are smaller, and the epidermis is green and not brown as in *Paranensis*. It is also somewhat like *U. Burroughianus*, (nobis,) from South America, but is not so transverse as that species, and is not so high on the umbonial slope. On the posterior slope there are two distinct rays from the beak to the margin, one being yellow and the other dark green. I name this in honor of the late Captain Brown, of Beverly, Mass., to whose kindness I owe the possession of the specimen.

UNIO WHEATLEYANUS. Pl. 29, fig. 23.

Testâ lævi, ellipticâ, inflatâ, inæquilaterali; valvulis crassis; natibus prominulis, costis elevatis; epidermide tenebroso-olivâ, rugoso-striatâ; dentibus cardinalibus magnis, crassiusculis, subdivisis; lateralibus longis crassisque; margaritâ vel albâ vel carneâ et iridescente.

Shell smooth, elliptical, inflated, inequilateral; valves thick; beaks a little prominent with large ribs; epidermis dark olive and rugosely striate; cardinal teeth large and somewhat thick, subdivided; lateral teeth long and thick; nacre white or flesh colored and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 94.

*Hab.*—Rio Plata, Mr. D'Orbigny; Rio Negro, Mr. Wheatley.

My cabinet and cabinet of Mr. Wheatley, New York.

Diam. 1·2,

Length 1·9,

Breadth 2·8 inches.

Shell smooth, elliptical, inflated, inequilateral, elevated on the posterior slope; substance of the shell thick, thinner behind; beaks a little prominent, with divergent and re-entering ribs at the apex; ligament rather short and stout; epidermis dark olive, rugosely striate and apparently without rays; umbonial slope obtusely angular;

cardinal teeth large, somewhat thick, double in both valves, crenulate; lateral teeth long, thick and slightly curved; the two inferior anterior cicatrices confluent, the superior one being distinct; posterior cicatrices confluent; dorsal cicatrices placed across the centre of the cavity of the beaks; cavity of the shell rather deep; cavity of the beaks shallow; nacre white or flesh color and iridescent.

*Remarks.*—A young shell, apparently not one-fourth grown, was sent to me some time since by Mr. C. M. Wheatley, who procured it from the Rio Negro, at the distance of 1200 miles from the mouth of the Amazon. After comparing this young individual carefully with all my South American specimens, and with the descriptions of Spix and Von Martius, as well as those of D'Orbigny, I am satisfied that it can only be assimilated to a specimen which that distinguished traveller and zoologist, Mr. D'Orbigny, sent to me with several other specimens as *U. lacteolus*, (nobis,) (*delodontus*, Lam.) I have always doubted that specimen being the same species with those which it accompanied, and now connect it with this young specimen under the name of my friend Mr. Wheatley. I am not prepared to say, when we shall find mature specimens from the Rio Negro, that it may not prove distinct from the shell from Monte Video. The form of the former is more triangular, and it varies in being flesh colored. The species above described may be distinguished from *delodontus*, Lam., by being less transverse, and having longer and larger diverging ribs at the beaks, which in both specimens before me converge a short distance below the tip of the beak so as to form re-entering angles. It differs from *Burroughianus*, (nobis,) and *Paranensis*, (nobis,) in being less transverse than the former, and being less rotund than the latter. It is also less rotund than *membranaceus*, Maton.

UNIO SUAVIDICUS. Pl. 29, fig. 24.

Testâ lævi, oblongâ, subcompressâ, valdè inæquilaterali, anticè rotundatâ, posticè truncatâ; natibus subprominentibus, costis elevatis; epidermide luteo-olivâ, minutè striatâ; dentibus cardinalibus parvis, compressis, crenulatis in utroque valvulo duplicibusque; lateralibus longis, lamellatis subrectisque; margaritâ cæruleo-albâ et iridescente.

Shell smooth, oblong, somewhat compressed, very inequilateral, rounded before and truncate behind; beaks a little prominent, with elevated ribs; epidermis yellowish olive, minutely striate; cardinal teeth small, compressed, crenulate and double in both valves; lateral teeth long, lamellar and nearly straight; nacre bluish white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 95.

*Hab.*—River Amazon. Mr. E. Verreaux, Paris.

My cabinet.

Diam. .4,

Length .6,

Breadth .8 inch.

Shell smooth, oblong, somewhat compressed, very inequilateral, rounded before and truncate behind, dorsal and basal lines nearly parallel; swollen before the umbonial



*Remarks.*—Among a number of interesting land and fresh water shells which I procured from Mr. E. Verreaux, in Paris, was a single small specimen of this species, evidently quite young. I should suppose about one-fourth grown. The above diagnosis therefore may be found to be, in many respects incorrect, when mature individuals shall be examined. The oblong outline of this shell is remarkably regular. The costæ of the beaks are smaller on the posterior and anterior slopes and several of them form re-entering angles on the posterior slope and on the sides. This species has some affinity to *Charruanus*, D'Orb., but differs in being more oblong, in having smaller costæ on the beaks, and in having the posterior slope more elevated.

Shell smooth, elliptical, rather inflated, inequilateral, subangular behind, rounded before; substance of the shell rather thin, thicker before; beaks slightly prominent; epidermis olive, without rays, highly polished and with transverse yellow bands; ligament short and very thin; umbonial slope obtusely angular; posterior slope rather flattened; cardinal teeth small, straight, compressed, crenulate and double in both valves; lateral teeth rather short, nearly straight, lamellar, single in the right, and double in the left valve, the lower division being much larger and rising towards the end into a crest; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices placed within the cavity of the beaks, and under the plate; pallial cicatrix

distinctly impressed; cavity of the shell rather deep and rounded; cavity of the beaks rather deep and subangular; nacre salmon color and iridescent.

*Remarks.*—I owe to the kindness of Prof. Nuttall, two specimens of this pretty little species, which he gave me on my last visit to England, in 1853. In outline it approaches *U. olivaceus*, (nobis,) from Calcutta, but is a little more angular on the posterior margin. It is by no means so thin in the substance of the shell, and differs in the teeth, they being in the *Nuttallianus* thicker and less lamellar. The color is very different, the *olivaceus* being pale blue, while both the specimens before me of *Nuttallianus* are salmon colored within and olive without, and with transverse bands. There is a group of *Uniones* in India, which are disposed to be bluish, and the *cæruleus*, (nobis,) may be considered decidedly the type. The *Nuttallianus* has an epidermis of rather a bluish green olive, and the nacreous matter deposited in the interior of the beaks of both specimens is decidedly blue. The tips of the beaks being eroded in both specimens, it is impossible to say if there be undulations, but the blue hue of the nacre in the beaks is very observable there. The outline of *U. Keraudreni*, Eydoux, is nearly the same with this species; but they are evidently distinct. I dedicate this pretty little species to my old friend Prof. Nuttall, who has done so much to elucidate the natural history and botany of the United States.

UNIO UMBROSUS. Pl. 30, fig. 26.

Testâ lævi, ellipticâ, subinflatâ, inæquilaterali; valvulis subcrassis; natibus prominulis; epidermide castaneâ, politâ, transversè fasciatâ; dentibus cardinalibus magnis, duplicibus subelevatisque; lateralibus longis, lamellatis subcurvisque; margaritâ vel purpureâ vel roseâ et iridescente.

Shell smooth, elliptical, somewhat inflated, inequilateral; valves rather thick; beaks a little prominent; epidermis chestnut brown, polished, transversely banded; cardinal teeth large, double in both valves and rather elevated; lateral teeth long, lamellar and somewhat curved, nacre purple or rose color and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 95.

*Hab.*—Medellin River, Mexico. Dr. Burrough.

My cabinet and cabinet of Mr. Anthony.

Diam. 1,

Length 1·7,

Breadth 2·9 inches.

Shell smooth, elliptical, somewhat inflated, inequilateral, flattened on the sides; substance of the shell rather thick, thinner behind; beaks a little prominent; ligament rather short and thick; epidermis chestnut brown, very smooth and polished with distant marks of growth and two or three rather broad, transverse, yellowish bands, very obscurely rayed; umbonial slope raised and subangular; cardinal teeth large, double in both valves, elevated into obtuse points and crenulate; lateral teeth long, lamellar, somewhat curved, the inferior division in the left valve is much the larger; anterior cicatrices distinct and well impressed; posterior cicatrices confluent; dorsal

cicatrices placed in the centre of the cavity of the beaks; pallial cicatrix well impressed; cavity of the shell rather deep and rounded; cavity of the beak somewhat deep and subangular; nacre purple or rose color and very iridescent.

*Remarks.*—When I described *Unio Tampicoensis*, in 1835, (Trans. Am. Phil. Soc. Vol. 6, p. 24,) I was in possession of the above described shell also by the kindness of the late Dr. Burrough. In the remarks, I then mentioned that in the younger specimens the epidermis was of a yellow brown, and that indistinct rays might be observed. Having had access to other specimens all of the same size, and particularly a fine one from Mr. Anthony, of Cincinnati, who also obtained it from Dr. Burrough's collection, I am satisfied that, although nearly allied to *Tampicoensis*, it must be considered to be distinct. It differs in being not quite so oblique, in the beaks not being so prominent, the epidermis not being blackish but of a fine dark brown. It also has obsolete rays, while the other seems to have none, and the nacre is disposed to be more rose color and purple. All the specimens before me are more or less thus colored, while *Tampicoensis*, is usually white with pinkish lateral teeth.

There is rather a remarkable feature in the three specimens before me, about the centre of the cavity of the interior of the disk, all of which are granulose with small irregular pearls.

UNIO NEWCOMBIANUS. Pl. 30, fig. 27.

Testâ corrugato-sulcatâ, rotundatâ, subcompressâ, inæquilaterali; valvulis erasis; natibus elevatis prominentibusque; epidermide tenebroso-olivaceâ, corrugatâ; dentibus cardinalibus submagnis, duplicibus subcompressisque; lateralibus subbrevis, erassis subcurvisque; margaritâ albâ.

Shell corrugately sulcate, rounded, somewhat compressed, inequilateral; valve thick; beaks elevated and somewhat prominent; epidermis dark olive, corrugate; cardinal teeth rather large, double and somewhat compressed; lateral teeth rather short, thick and somewhat curved; nacre white.

Proc. Acad. Nat. Sci. Vol. 8, p. 103.

*Hab.*—Nicaragua. W. Newcomb, M. D.

My cabinet and cabinets of Dr. Newcomb, Albany, and C. M. Wheatley, New York.  
Diam. .6, Length 1.1, Breadth 1.3 inch.

Shell roughly furrowed, rounded, somewhat inflated over the umbones and flattened towards the basal margin, inequilateral; substance of the shell thick, thinner behind; beaks elevated, somewhat prominent and subangular; furrows transverse and roughly wrinkled, rather close and covering the whole disk; ligament very short and not very thick; epidermis dark olive and roughly wrinkled; umbonial slope obtusely angular; cardinal teeth rather large, somewhat compressed, double in both valves; lateral teeth single in the right and double in the left valve; rather short, thick and somewhat curved, in the left valve the inferior division being clavate, the superior very small and

thin; anterior cicatrices distinct and deeply impressed; posterior cicatrices confluent and rather deeply impressed; dorsal cicatrices numerous and placed within the cavity of the beaks; pallial cicatrix distinctly impressed; cavity of the shell rather shallow and regularly rounded; cavity of the beaks rather deep and angular; nacre white.

*Remarks.*—Among the *Uniones* of Lake Nicaragua, this species, taken by Dr. Newcomb, has not, I believe, heretofore been observed. It is a very remarkable species, as well from its outline, as from its singular corrugate and furrowed disk. It differs from all the species which I know, in this character. We have some species of *Naiades* with wrinkled epidermis,\* but not so much so as this, nor are they accompanied by furrows like this. It differs from *U. aratus*, (nobis,) also from Lake Nicaragua, in being round and in having wrinkles as well as furrows. Two of the three specimens before me are adult, and in these there is apparently, in the left valve, a disposition to form a third division of tooth. The largest of the three specimens is probably a female, as there is an enlargement at the posterior basal margin, which indicates that sex. It causes the outline to present a subtriangular form, which is not the case with the other two.

I owe to Dr. Newcomb the possession of this beautiful little species, as well as many other fresh water and land shells, and with pleasure dedicate it to him, who has proved so industrious and successful an investigator in this branch of Zoology.

UNIO CAMBODIENSIS. Pl. 30, fig. 28.

Testâ lævi, ellipticâ, subinflatâ, inæquilaterali; valvulis subtenuibus; natibus prominentibus, ad apicem undulatis; epidermide castaneâ, eradiatâ, politâ; dentibus cardinalibus longis, rectis lamellatisque; lateralibus sublongis, lamellatis subrectisque; margaritâ albâ et iridescente.

Shell smooth, elliptical, rather inflated, inequilateral; valves rather thin; beaks a little prominent, undulated at the tip; epidermis chestnut colored, without rays and polished; cardinal teeth long, straight and lamellar; lateral teeth rather long, lamellar and nearly straight; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 103.

*Hab.*—Tackrong River at Korat, Cambodia. S. R. House, M. D.

Cabinet of Mr. W. A. Haines.

Diam. .4,                                      Length .5,                                      Breadth 1 inch.

Shell smooth, elliptical, rather inflated, inequilateral, sub-biangular behind; substance of the shell thin; beaks a little prominent and subinflated, undulated at the tip; epidermis chestnut color disposed to rufous, without rays, shining; ligament very short and thin; umbonial slope obtusely angular; posterior slope carinate, with two raised lines running from the beak to the posterior basal margin, nearly covered with minute folds; cardinal teeth long, straight, lamellar, single in the *left* and double

\* *Anadonta crispata*, Lam., from Cayenne, and *An. tortilis*, (nobis,) from Carthage.

in the *right* valve, the inferior division passing under the superior one; lateral teeth rather long, lamellar, nearly straight, single in the right and double in the left valve; anterior cicatrices confluent; posterior cicatrices confluent; dorsal cicatrices placed within the cavity of the beaks and on the under side of the cardinal tooth; pallial cicatrix slightly impressed; cavity of the shell deep and rounded; cavity of the beaks deep and subangular; nacre white inclining to salmon and iridescent.

*Remarks.*—Among the shells from Takrong River, was a single small *Unio* which has the appearance of being nearly, if not quite mature. It has that character of the cardinal teeth, being single and double on the reversed sides, so common with the species from the East of Asia. The tips of the beaks being eroded, the character of the undulations cannot be given, but it is evident from those which may be yet seen on the posterior slope of this specimen, that they must be numerous, regular and close. In outline and in color it is near to *U. crocatus*, (nobis,) from Georgia; but is a much smaller species and rather more transverse.

UNIO COLORADOENSIS. Pl. 31, fig. 29.

Testâ lævi, ellipticâ, inflatâ, valdè inæquilaterali; valvulis crassis; natibus elevatis magnisque; epidermide luteo-castaneâ, obscure radiatâ et politâ; dentibus cardinalibus magnis, duplicibus, acuminatis crenulatisque; lateralibus magnis, praelongis, lamellatis subcurvisque; margaritâ purpureâ et iridescente.

Shell smooth, elliptical, inflated, very inequilateral; valves thick; beaks elevated and large; epidermis yellowish chestnut, faintly rayed and polished; cardinal teeth large, double, pointed and crenulate; lateral teeth large, very long, lamellar and somewhat curved; nacre purple and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 103.

*Hab.*—Rio Colorado, Texas. B. W. Budd, M. D.

My cabinet and cabinet of Dr. Budd.

Diam. 1·8,

Length 3·1,

Breadth 4·9 inches.

Shell smooth, elliptical, inflated, very inequilateral, subbiangular behind; substance of the shell thick, thinner behind; beaks elevated and large; epidermis yellowish chestnut, faintly and closely rayed and polished on the umbones; ligament large, long and thick; umbonial slope rounded and inflated; posterior slope raised into a carina; cardinal teeth very large, double in both valves, pointed and crenulate; lateral teeth single in the right and double in the left valve, very large, lamellar and somewhat curved; anterior cicatrices distinct, the inferior large and deeply impressed; posterior cicatrices confluent, large; dorsal cicatrices numerous, deeply impressed and crossing the cavity of the beak; pallial cicatrix large and deeply impressed; cavity of the shell large; cavity of the beaks large and rounded; nacre purple and very iridescent.

*Remarks.*—Dr. Budd, to whose kindness I owe the possession of this shell, has a second specimen, and these are the only two I have seen. It is nearly allied to *purpuratus*, Lam., on one side, and to *alatus*, Say, on the other; it is less inflated

than the first, and more inflated than the latter, and the posterior slope is nearly raised into a wing. It is not obovate like *purpuratus*. Young and perfect specimens will probably be found to be quite alate. The purple color of the specimen before me is not quite so dark as the *alatus* and *purpuratus*. In my specimen there is in each valve an imperfect cicatrix, situated nearly in the centre of the interior of the disk, and such may be the case with Dr. Budd's. If this should be found to be developed in the species, it will resemble in this character the *trapezoides*, (nobis,) the only *Unio* I know to possess the additional muscle (ventral muscle). The beaks of the specimen before me are too much eroded to give the character of the tips, but they are evidently slightly undulate.

It differs from *Tampicoensis*, (nobis,) to which it is allied, by being a larger species, being higher in the carina of the posterior slope, in having a brown radiated epidermis instead of a blackish rayless one, and in the purple color of the nacre.

UNIO POEYANUS. Pl. 32, fig. 30.

Testâ lævi, transversâ, subcylindraceâ, ad basim subemarginatâ, valdè inæquilaterali, ad latere planulatâ, posticè truncatâ et subbiangulatâ; valvulis suberassis; natibus prominulis, ad apicès simplicibus; epidermide luteolâ et minutè granulatâ; dentibus cardinalibus subcompressis, acuminatis crenulatisque; lateralibus prælongis, lamellatis rectisque; margaritâ luteolâ et iridescente.

Shell smooth, transverse, subcylindrical, basal margin somewhat emarginate, very inequilateral, flattened at the side, truncate and subbiangular behind; valves a little thickened; beaks slightly elevated, simple at the tip; epidermis yellowish and very minutely granulate; cardinal teeth somewhat compressed, acuminate and crenulate; lateral teeth very long, lamellar and straight; nacre yellowish and iridescent.

Proc. Acad. Nat. Sci. 1857. p. 85.

*Hab.*—Rio de las Balsas, near Coyucan, Mexico. Prof. Felipe Poey, of Havana.

My cabinet and cabinet of Prof. Poey.

Diam. .6,

Length 1,

Breadth 2.2 inches.

Shell smooth, transverse, subcylindrical, basal margin somewhat emarginate, very inequilateral, flattened at the side, truncate and subbiangular behind and rounded before; substance of the shell somewhat thick, thicker before; beaks slightly elevated, and without any undulations at the tip: ligament long and rather thin; epidermis yellow or yellowish olive, very minutely granulate, striate before; umbonial slope somewhat carinate; marks of growth distant; cardinal teeth somewhat compressed, acuminate and crenulate; lateral teeth very long, lamellar and straight; anterior cicatrices distinct; posterior cicatrices nearly distinct; dorsal cicatrices placed across the cavity of the beaks; pallial cicatrix slightly impressed; cavity of the shell shallow; cavity of the beaks small and subangular; nacre yellowish, paler before and iridescent.

*Remarks.*—I owe to the kindness of Professor Poey the possession of two specimens of this interesting species, and I dedicate it to him. In its outline it is nearly like

that of *Unio cylindricus*, Say, but it is a much thinner shell and entirely without tubercles, which are so remarkable on the umbonial slope of that species. It is closely allied to *U. Popeii*, (nobis,) but is not so much compressed, is different in color, more cylindrical as well being furnished with granules. The epidermis of *Poeyanus* is very remarkable. It is very thin and firmly attached to the calcareous matter, and when examined with a good lens very minute granules may be seen over the surface; at the anterior part the striæ are imbricate. The two specimens differ in color. The younger, being half grown, is of a straw yellow, while the older one is an olive yellow to that point of growth, and straw yellow beyond that to the margin. The younger is entirely without rays, while the older has obsolete rays on the posterior portion.

ANODONTA HOLTONIS. Pl. 32, fig 31.

Testâ lævi, oblongâ, inflatâ, valde inæquilaterali, e natibus lineatis; valvulis subcrassis; natibus subprominentibus; epidermide tenebroso-olivaceâ, striatâ; margaritâ cæruleâ et valdè iridescente.

Shell smooth, oblong inflated, very inequilateral, with diverging lines from the beaks; valves rather thick; beaks somewhat prominent; epidermis dark olive, striate; nacre bluish white and very iridescent.

Proc. Acad. Nat. Sci. 1857, p. 85.

*Hab.*—Near Cartago, New Granada. Rev. J. F. Holton.

My cabinet and cabinets of Mr. Holton, Mr. Wheatley and Lyceum of Nat. Hist., New York.

Diam. .9,                                      Length 1.3,                                      Breadth 2.7 inches.

Shell smooth, oblong, inflated, very inequilateral, with crimped lines radiating from the beaks, obtusely angular behind; substance of the shell rather thick; beaks somewhat prominent; ligament rather long and thin; epidermis dark olive, minutely crimped over the posterior slope and crimped in lines on the sides from the beaks to the basal margin, with three obscure greenish lines on the posterior slope; umbonial slope slightly rounded; marks of growth distant and not very distinct: anterior cicatrices distinct, the adductor being very large, the tractor very small: posterior cicatrices large and confluent; dorsal cicatrices small and placed on the upper side of the cavity of the beaks; pallial cicatrix slightly impressed; cavity of the shell deep and rounded; cavity of the beaks rather deep and subangular; nacre bluish white and very iridescent.

*Remarks.*—This species, of which I have but a single specimen before me, was brought by the Rev. Mr. Holton from the upper Cauca, interior of New Granada, where they are found in abundance, in "a pond, like the Illinois Prairie Ponds, an acre in extent, with muddy shores, being 6 to 15 feet deep in the centre, without inlet or outlet, and not surrounded by marshy ground, the distance from the Cauca River being 5 miles. This pond is within half a mile of Cartago."



The above described species is more like *Anodon radiatus*, Spix, (Test. Fluv. Bras. pl. 23, fig. 1,) than any other South American species. It is about the same size, but in outline it differs by being more oblong and less elliptical. It differs also in not being rayed. It is very nearly of the same outline with *Anodonta fluviatilis* of our rivers, but it cannot be confounded with that species, as it has the peculiarly formed fosset at the posterior end of the ligament, which is so remarkable in the South American *Anodontæ*. The singular crimped rays in the epidermis are very remarkable, but it may not be a permanent character of the species. It is to be regretted that a single specimen only has come under my view. I owe this one to the kindness of the Rev. Mr. Holton, who mentions in his travels that they were in abundance near Cartago, and to him I dedicate it.

### Family NAIADÆ.

#### Subgenus PLAGIODON.\*

Testâ æquivalvis, inæquilatera, obliquè trigona, valdè inflata; dentibus cardinalibus crenulatis, compressis, transversis, curtis, in utroquè valvulo duplicibus; dentibus lateralibus nullius; ligamentum vix extorsum; impressio muscularis antiè composita.

Proc. Acad. Nat. Sci. Vol. 8, p. 79.

Shell equivalve, inequilateral, obliquely trigonal, very much inflated; cardinal teeth crenulate, compressed, transverse, short, double in each valve; no lateral teeth; muscular impression composite before.

This subgenus is proposed for a fluviatile shell, which is nearer to *Monocondylæa*, D'Orbigny, than to *Margaritana*, Schumacher, and may be considered properly, as so interposed as a link to connect them. It has the epidermis of *Monocondylæa*, being of a dull cloth-like texture, and not polished and smooth, like the *Unio* generally is. The point in which it chiefly differs is the peculiar structure of the teeth. As in *Monocondylæa* there is no lateral tooth, the part of the dorsal margin where that exists in the *Unio* forming a plate, is here simply a line, forming a margin over a deep cavity, on which line is placed a thin delicate ligament. The cardinal tooth is large, but unlike the *Margaritana* it is transversely compressed, and the upper division is longer and begins immediately over the lower one, between it and the beak. In *Monocondylæa* the cardinal teeth consist of one smooth rather large lobe or callus, in each valve, passing each other, and fitting into a corresponding depression in the opposed valve. If we may judge from a single specimen of *Plagiodon* I should conclude that the substance of the valves was never so thick as that of *Monocondylæa*. It is much more inflated, the three diameters being nearly the same, that through the axis being rather smaller. Being a very light shell, and having so peculiar a form, it cannot be very locomotive. From its rotundity, and having the beaks nearly

\* πλαγίως, transversus and ἰσός, dens.

terminal, incurved and recurved, it at once reminds one of *Isocardia cor*, Lam., or rather of *Isocardia Moltkiana*, Lam., having a notable angle on the umbonial slope and presenting a perfectly cordate form on the anterior view. The posterior cicatrices are confluent like *Monocondylœa*, and but slightly impressed. The inferior anterior cicatrices are deeply impressed, and so closely united as scarcely to be distinguishable. The superior anterior cicatrix is placed on the inner side of the cardinal tooth, and higher up than on that of the *Monocondylœa*. The dorsal cicatrices are placed so far into the deep cavity of beaks, as to be but partly and faintly visible.

The absence of the soft parts of this shell is greatly to be regretted. From the globular form, the epidermis and the teeth, we would be led to expect to find something different in the structure of some of its organs, as it is very likely to be in its habits, from *Monocondylœa* or *Unio*.

Judging from a very imperfect left valve of *Monocondylœa Guarayana*, D'Orb., all that I have seen, I should not be surprised if it would prove to belong properly to this genus. Certainly the form of tooth is different from that of the other *Monocondylœa*. It is, however, very much compressed, and is much thicker in the substance of the shell.

The epidermis of *Plagiodon* is of that texture and color, which reminds one of some of the estuary genera, *Cyrena*, *Clathrodon*, &c., but its pearly nacre and form of teeth place it among the *Naiades* without doubt.

PLAGIODON ISOCARDIODES. Pl. 32, fig. 32.

Testâ lævi, rotundo-trigonâ, globosâ, ventricosissimâ, ad lateris planulatis, valdè inæquilaterali, anticè brevissimâ, umbonibus tumidis, valvulis subtenuibus; natibus valdè elevatis, incurvis terminalibusque; epidermide subrugosâ, tenebroso-olivaceâ; dentibus cardinalibus crenulatis, compressis, transversis, curtis in utroque valvulo duplicibusque; margaritâ albâ et iridescente.

Shell smooth, subtriangular, globose, very much inflated, flattened at the sides, very inequilateral, truncate before, swollen on the umbones; valves rather thin; beaks very much elevated, incurved, terminal; epidermis dull, dark olive; cardinal teeth crenulate, compressed, transverse, short, double in each valve; nacre white and iridescent.

Proc. Acad. Nat. Sci. Vol. 8, p. 79.

*Hab.*—Rio Plata. Mr. E. Verreaux, Paris.

My cabinet and cabinet of Mr. Verreaux.

Diam. .9,

Length .9,

Breadth 1.1 inch.

Shell smooth, subtriangular, globose, very much inflated, flattened at the sides, very inequilateral, truncate before, subemarginate, swollen on the umbones; substance of the shell rather thin, thicker before; beaks very much elevated, incurved and recurved; ligament very small, nearly black, thin and not raised above the plane of

the posterior slope; epidermis dull, dark olive and without rays; umbonial slope angular; posterior slope very broad and flattened, with two obscure impressed lines; anterior slope widely cordate and flattened, with a large, slightly impressed furrow; anterior lunule broad with several transverse, impressed parallel lines; cardinal teeth crenulate, compressed, transverse, short, the upper division longer, double in each valve; the two anterior inferior cicatrices deeply impressed and confluent, the superior one placed on the inner side of the tooth; posterior cicatrices confluent; dorsal cicatrices placed within the cavity of the beaks, and but partly visible; pallial cicatrix very slightly impressed; cavity of the shell very deep and rounded; cavity of the beak very deep and subangular; nacre white and very iridescent.

*Remarks.*—I procured this very remarkable shell in Paris, from Mr. E. Verreaux, whose researches and collections in South America, Africa, &c., have been so extensive. It has the general aspect of a very much inflated *Monocondylaea Paraguayana*, D'Orb., but the form of the teeth is totally different, and the shell thinner and more vesicular. The anterior slope is almost as cordate as *Isocardia Moltkiana*, Lam., the beaks presenting an incurved form somewhat like that shell. The angle on the umbonial slope is also somewhat similar and it has a like flattened side. The anterior lunule is very wide, and immediately under the point of the beaks there are three transverse impressed lines, very unusual in the *Naiades*, which may not be constant even in this species.

#### TRIQUETRA CONTORTA. Pl. 33, fig. 33.

Testâ nodulosâ, transversissimâ, subcompressâ, tortuosâ, valdè inæquilaterali, posticè acuto-angulatâ; anticè caudatim productâ; valvulis crassis; natibus parvis, prominulis, ad quartam anteriorem partem positis; epidermide striatâ, tenebroso-fuscâ; dentibus cardinalibus subgrandibus, crenulatis, in utroque valvulo duplicibus; lateralibus prælongis curvisque; margaritâ argenteâ et iridescente.

Shell verrucose, exceedingly transverse, rather compressed, twisted, very inequilateral, acutely angular behind; anterior margin lengthened into a tail; valves thick; beaks small, slightly prominent and placed one-fourth from the anterior margin; epidermis striate, dark brown; cardinal teeth rather large, crenulate and double in both valves; lateral teeth exceedingly long and curved; nacre silvery white and iridescent.

*Triquetra lanceolata*, Lea. Proc. Acad. Nat. Sci. Vol. 8, p. 79.

*Hab.*—China. Mr. Asa Fitch and H. Cuming, Esq.

My cabinet and cabinet of H. Cuming, Esq., London.

Diam. .9.

Length 1.3.

Breadth 5.8 inches.

Shell warty, exceedingly transverse, rather compressed, twisted, very inequilateral, acutely angular behind; anterior margin lengthened into a tail-shaped prolongation; substance of the shell thick; beaks small, slightly prominent and placed one-fourth of the whole breadth from the anterior margin; epidermis striate, dark brown and

without rays; lines of growth numerous and distinct; ligament very long and slender; umbonal slope slightly angular; cardinal teeth rather large, erect, crenulate and double in both valves; lateral teeth very long, rather compressed, curved and enlarged at the posterior end; anterior cicatrices deeply impressed and all three distinct; the posterior cicatrices distinct, the inferior one being large and inflected, the superior one being small and very much removed from the great one; dorsal cicatrices forming a long row across the cavity of the beaks; pallial cicatrix rather deeply impressed; cavity of the shell deep in the left valve and shallow in the right; cavity of the beaks very shallow; nacre silvery white.

*Remarks.*—This very remarkable species of the *Triquetra*, of Klein, (*Hyria*, of Lamarck,) was first placed in my hand by Tho. R. Ingalls, M. D., to whose kindness I am indebted for many new species from rare and distant habitats. This specimen consists only of the right valve, and was among shells received by Mr. Asa Fitch, of Salem, New York, in a box from China, with *Anodonta magnifica*, *Dipsas plicatus*, and other well known Chinese species.

This is certainly the most remarkable form of any of the genus *Triquetra* yet observed. Its remarkable transverseness at once removes it from *subviridis*, Klein, (*avicularis*, Lam.) In outline it approaches *Spatha celestis*, (nobis.) It is the first time that this genus has been observed out of South America, where it has heretofore been considered to be peculiar. The great posterior cicatrix is of an unusual form, being irregularly elongate and but slightly oblique to the tooth above it. The minor superior cicatrix is unusually distant from the posterior terminal point of the lateral tooth, where it is usually placed in all the family *Naiades*. In this shell it is removed quite half an inch from the point, and placed rather below the tooth itself and nearly perpendicular to the end of the great cicatrix, which here is obliquely directed towards the *anterior* instead of the *posterior* margin. The three anterior cicatrices are remarkably distinct, the superior one being placed on the end of the cardinal tooth. There is an appearance of a row of cicatrices under the dorsal line, *anterior* to the *great cicatrix*, which is situated *anteriorly* to the *cardinal tooth*. The whole interior of the valve is covered with beautiful minute papillæ. The beak is so much eroded that it is impossible to say if the tips in a perfect state be undulate or not.

In the short diagnosis which I made of this new species of *Triquetra*, (Proceedings, vol. viii. p. 79,) I had but a single valve, which had the appearance of being twisted like *Arca tortuosa*, Lin. This extraordinary form, which had never been suspected to exist in any member of the family *Naiades*, excited great interest with the Zoologists who saw it; but it was still a matter of doubt whether the curve, although exceedingly regular and presenting no appearance of constraint or injury, might not be abnormal. This doubt has now, however, been put entirely at rest, for the curve

of the two specimens now before me, are so precisely the same, that when the odd right valve is placed against the left of the other, they fit perfectly, proving that the curve is a mathematical law belonging to the species. The specimen now figured belongs to H. Cuming, Esq., of London, and is nearly perfect. My single valve was recognized by Mr. Cuming at once, on his recent visit to this country, to be the same as that in his cabinet, and he promptly and liberally offered to place this unique specimen in my hands, for a more perfect description and figure than could be given of the single immature valve I already had. Mr. Cuming's specimen is nearly six inches along the dorsal line to the angle of the posterior margin, and this line deflects quite two inches in the course of the six inches from a straight line, and it is so twisted that the basal margin at the posterior end turns up to be on a plane with the dorsal line at the beaks. This remarkable curve causes the long lateral teeth to have a curve of double curvature. The greatest distance from the dorsal to the basal margin is one inch and three-tenths. The greatest diameter is nine-tenths of an inch, which gives it a sub-cylindrical form, and it is not unlike a twisted banana, (*Musa sapientum*.) This perfect specimen presents the superior portion of the valves covered with small, regular tubercles, which was not suspected in the original, somewhat imperfect single valve, there being on it only a few irregular undulate markings. Mr. Cuming's specimen settles the doubt as to habitat. He received his from Shanghai, and therefore Mr. Fitch and Dr. Ingalls, to whom I owe the possession of the single valve, were right in assigning it to China. Doubts arose of this from the fact that, heretofore, *Triquetra* has been considered to be confined to South America. I propose the name should be changed from that I originally gave it, (*T. lanceolata*), as inappropriate to the complete mature shell, to that of *contorta*, which is very descriptive, and can never be mistaken.



ART. XX.—*Observations on a group of Cretaceous Fossil Shells, found in Tippah County, Miss., with descriptions of fifty-six new species.*

By T. A. CONRAD.

The Cretaceous strata of Mississippi have long since been observed and partially noticed by geologists, and the lamented Professor Tuomey has described a number of their fossil contents. I now introduce quite a distinct group of shells, which are imbedded in a different matrix compared with the prevalent cretaceous marls, green sand and limestones. The discovery of these beautiful organic remains is due to the indefatigable exertions of Dr. W. Spillman, of Columbus, who has forwarded a collection of specimens more or less perfect, consisting of nearly sixty species, all of which appear to be unpublished except *Scaphites Conradi*. The appearance of these shells is like that of eocene species which have merely lost their animal matter, and in this respect are very unlike the condition of similar genera in the contiguous rocks of the same era. The fossils are imbedded in a sandy marl of a dark gray color, the principal constituents of which are fine scales of mica and grains of quartz mixed with fragments of small shells; and though some of the very thin species are distorted, the stronger retain their original shapes and are generally very perfect. Species of CRASSATELLA, NUCULA and MERETRIX have the valves united as in life, as well as a few of the extremely thin INOCERAMI, though the latter have been more or less distorted by pressure. The numerical proportion of species of Cephalo and Acephala is nearly equal. The external sculpture of all is as sharply defined as in existing species. Besides SCAPHITES and BACULITES, there is only one shell in the collection which resembles a species of the green sand or limestone, and it is quite distinct. The rare genus PULVINITES is herein for the first time introduced as an American form. The analogous species, as well as that of GERVILLIA, occurs in the Baculite limestone of France and Normandy, which I believe is referred by D'Orbigny to his Senonien Stage, the same in which he includes the Cretaceous fossils of North America.

It is interesting to find bivalves of so remote an era in sufficient preservation to exhibit generic characters as clearly defined as they are in living shells. In this condition are the hinges of GERVILLIA, PULVINITES, CTENOIDES and CARDIUM. There are also specimens of BACULITES and SCAPHITES which exhibit the interior divested of all extraneous matter, and delight the eye with exquisite curves of the foliated septa, whilst the shells glow with brilliant iridescent tints.



This beautiful series of cretaceous forms seems to be very limited in geographical distribution, so far as our present knowledge extends. It is probably unknown as yet beyond the limits of Tippah County, which borders on Tennessee. No account has been given of such a group by the State Geologists of Tennessee or Alabama. Dr. Spillman informs me, "The fossils you have now under examination were found in the bluffs of Owl creek, three miles north of the town of Ripley," and he concurs in opinion with me that they might properly be named the "Ripley group." He also remarks that *Ammonites placenta* occurs in it with the shell preserved, and that in connection with the Ripley group, or in the same locality, are "*Exogyra costata*, \**Gryphæa mutabilis*, *Ostrea plumosa*, *Natica petrosa*, *Nautilus Dekayi*, &c., with the shell more or less preserved, in an argillo-calcareous marl," but none of these species are contained in his collection sent me from Tippah County.

Professor Harper, in his report for 1857, describes some of the localities of the above group near Ripley, and names many of the genera of its contained fossils.

It would perhaps be convenient to designate these strata Upper Cretaceous, in contradistinction to the limestones and marls beneath, which are palæontologically so distinct.

#### ACEPHALA.

##### PHOLADOMYA, *Sowerby*.

PHOLADOMYA TIPPANA. Pl. 34, fig. 9. Acutely subovate, very thin, profoundly ventricose, with numerous radii, curved and dichotomous on the anal side.

An imperfect specimen, with a portion of the shell, has been restored to an approximate outline in the figure. The sculpture is in sufficient preservation to characterise the species.

##### PERIPLOMA, *Schum.*

PERIPLOMA APPLICATA. Oblong-oval, equilateral, compressed, thin and fragile; right valve convex-depressed; left valve flattened or slightly concave, with an oblique anterior carinated line; valves smooth in the middle, roughened with rugose concentric lines posteriorly; anterior end truncated or obtusely rounded, nearly direct; basal margin contracted in the middle.

Length  $1\frac{1}{2}$  inches.

##### SILICUARIA, *Schum.*

SILICUARIA BIPPLICATA. Pl. 34, fig. 17. Thin, convex, with two radiating folds or depressions anteriorly; basal line slightly contracted or incurved; anterior side short,

\**Ostrea vesicularis*, *Lam.*

extremity truncated; posterior margin obtusely rounded, posterior side concentrically lineated; valves somewhat contracted obliquely from beak to base.

An elegant species, remarkable by the slightly undulated anterior. Substance of shell thin and fragile, yet one perfect valve is in Dr. Spillman's collection.

Family *SOLENIDÆ*.

*LEGUMEN*, *Conrad*.

Shell equivalve, very inequilateral, flattened; hinge with two very slender teeth in the right valve under the beak, and one posterior very oblique prominent lamelliform tooth.

This genus is perhaps most nearly related to *CULTELLUS*, *Schum*. It can readily be distinguished by external characters; its flat valves, straight and more produced anterior side, &c.

*LEGUMEN ELLIPTICUS*. Pl. 34, fig. 19. Oblong, compressed, very inequilateral, very thin; valves flattened or contracted obliquely from beak to base, concentrically lineated; beak not prominent above the hinge line, apex acute; ends regularly and nearly equally rounded; posterior extremity situated much more nearly on a line with the hinge than the ventral margin.

One right valve only is before me. The cardinal teeth are well preserved; two slender and very prominent, and one lamelliform, posterior, oblique.

*LEGUMEN APPRESSUS*. Elongated, much compressed; beak not prominent above the hinge line; hinge and base nearly parallel; posterior extremity acutely rounded, and nearly on a line with the hinge; valves finely striated with close regular impressed lines.

Smaller and proportionally longer than the preceding. It came to hand too late to be figured.

*DOSINIA*, *Scopoli*.

*DOSINIA DENSATA*. Pl. 34, fig. 13. Subtriangular or suborbicular, inequilateral, rather thick in substance; length rather more than the height; concentric striae obsolete, except towards the apex; posterior side prominently wrinkled towards the margin; posterior margin obliquely truncated; beaks not prominent.

In old specimens the anterior margin is truncated, and rounded in the young, which are more orbicular. The cardinal plate is broad, the teeth very prominent and the anterior tooth of the left valve very thick inferiorly.

This is the second species of *DOSINIA* found in the American Cretaceous strata. The first occurs in the older division.

MERETRIX, *Lam.*

MERETRIX TIPPANA. Pl. 34, fig. 18. Subtriangular, obsoletely striated concentrically; anterior side slightly compressed, with an ascending basal margin, extremity rather acutely rounded, distant from the apex; base a little prominent in the middle subtruncated on either side; posterior end but slightly more obtuse than the anterior beaks prominent.

PAPYRIDEA, *Swains.*

PAPYRIDEA BELLA. Suboval, very thin and fragile, ventricose; radii angular, prominent, about 30 in number, towards the extremities minutely tuberculated; ribs obsolete near the buccal end; basal margin somewhat salient opposite the umbo; truncated posteriorly; anal end truncated, nearly direct.

This species is proportionally shorter than the *elegantulum* or *protextum*. The largest specimen in Dr. Spillman's collection is not so large as those species usually are. Received since the plates were finished.

There are two other species of this genus in the inferior Cretaceous marls. *Papyridea* (*Cardium*) *elegantulum*, Roemer, and *P.* (*Cardium*) *protextum*, Con.

CARDIUM, *Lin.*

1. CARDIUM TIPPANUM. Pl. 34, fig. 8 b. Cordate, profoundly ventricose, rather thick; umbo and summit prominent; ribs flattened, little prominent, tricarinate, armed with prominent erect spines; in the intercostal space is a row of minute tubercles, except on the posterior side, where a prominent intercostal line appears.

A mere fragment, so well marked, however, that the description and figure will characterize the species.

2. CARDIUM RIPLEYENSE. A small cordate species, with minute equal radii, between each of which is a series of comparatively long hair-like spines.

Subgenus LÆVICARDIUM, *Swainson.*

3. CARDIUM SPILLMANI. Pl. 34, fig. 3. Oblong or profoundly elevated, inequilateral, profoundly ventricose; umbo and summit elevated; beaks nearly contiguous; surface with distant irregular grooves on the anterior side, and 3 to 5 radiating slightly impressed furrows on the umbonal slope.

Length  $2\frac{7}{8}$  inch. Height  $4\frac{3}{4}$  inch.

A large and remarkably elevated species with a very thick hinge and profound teeth. The surface is smooth and only ribbed about the umbonal slope, and on the posterior side of the umbo where in one specimen are about 18 radii; those behind the umbonal slope fine and indistinct without the aid of a glass. Named in honor of Dr. W. Spillman.

OPIS, *Defrance*.

1. OPIS BICARINATA. A small orbiculato-trapezoidal, ventricose species, smooth; umbonal slope and posterior submargin carinated, postal area concave.

2. OPIS BELLA. Triangular, convex, polished, with regular and elegant concentric lines, or minute flat ribs, separated by linear grooves; posterior side cuneiform.

About the size of the following species of *Tellina*, but a little longer and more pointed posteriorly.

## TELLINA.

TELLINA RIPLEYANA. Ovato-triangular, equilateral, compressed, polished; concentrically lineated towards anterior extremity. Length nearly  $\frac{1}{2}$  inch; height nearly  $\frac{3}{8}$  inch.

This and the two preceding species of OPIS were discovered after the plates were finished. They will be figured in a future number of this Journal.

CRASSATELLA, *Lam.*

CRASATELLA RIPLEYANA. Pl. 35, fig. 3. Triangular, very inequilateral, thick, flexuous or plicate posteriorly; umbonal slope angulated, subcarinated; disk covered with numerous irregular concentric furrows or coarse prominent lines; posterior side cuneiform, extremity obtusely rounded; margin above obliquely truncated; posterior margin opposite the umbo angulated; inferiorly concave; margin densely crenulated within.

This, from the number of specimens sent, I judge to be an abundant species, very distinct from all others of this country which have hitherto been described. The cardinal plate is very broad, and the teeth thick and prominent. Its state of preservation is equal to that of any Tertiary bivalve.

NUCULA, *Lam.*

NUCULA PERCRASSA. Pl. 35, fig. 4. Triangular, very thick, ventricose, inequilateral, densely radiated with minute impressed lines; anterior end subnasute, margin obliquely truncated; posterior side cuneiform, extremity slightly salient, rounded, situated much above the line of the base; basal margin rounded, sometimes slightly contracted anteriorly; within crenulated on the margin; submargin thickened; cicatrices deeply impressed; cardinal teeth thick, fosset oblique.

This species appears to be abundant and in excellent preservation; one specimen has the valves united. The interior is silvery; the pallial impression very distinct, and an irregular line of five small cicatrices runs over the upper part of the valves in the direction of the shell's length. The form of this NUCULA is very unlike any other American species.

CIBOTA, *Browne*.—BYSSOARCA, *Swainson*.

CIBOTA LINTEA. Pl. 34, fig. 11. Rhomboidal, very inequilateral; sides flattened or slightly contracted, radii minute, close, reticulated, except on anal side, where the radii are wider and smooth; hinge and basal margins parallel, the latter slightly contracted; anal margin very obliquely truncated.

This genus has been named NAVICULA by Blainville, and BYSSOARCA by Swainson.

CUCULLÆA, *Lam.*

CUCULLÆA CAPAX. Pl. 35, fig. 2. Obliquely triangular, inequilateral, profoundly capacious, elevated; posterior slope flattened, very broad, forming nearly a right angle with the terminal umbonal slope which is abruptly rounded; valves slightly contracted; umbo profoundly prominent, beaks distant; surface reticulated with fine lines, the radii in pairs, most conspicuous posteriorly, largest on the left valve.

2. CUCULLÆA TIPPANA. Pl. 35 fig. 1. Short trapezoidal, inequivalved, inequilateral, ventricose; radiating lines numerous, reticulated, most conspicuous on the left valve; umbo prominent; beaks rather distant; cardinal area profound, with three angular impressed lines; umbonal slope acutely rounded.

In the specimen figured, the margin of the larger valve is thick, abruptly grooved within, in which groove the margin of the opposite valve is inserted. Allied to *C. Shumardi*, Meek.

DREISSENA, *Van Beneden*.

DREISSENA TIPPANA. Pl. 34, fig. 14. Falcate, with distinct lines of growth; front excavated, the margin acutely angular; the dorsal and posterior margin form a regular curve; base rounded; beaks acute.

This shell somewhat resembles *Dreissena polymorpha*. The hinge is not accessible in the only specimen in the collection. The valves are united and are remarkably perfect. The form is not unlike that of *Mytilus falcatus*, D'Orbigny.

PINNA, *Lin.*

PINNA LAQUEATA. A fragment—ventricose, with eleven prominent, slender ribs; interstices concave.

GERVILLIA, *DeFrance*.

GERVILLIA ENSIFORMIS. Pl. 34, fig. 10. Ensiform or falcate, profoundly compressed, iridescent; hinge with about twenty-seven radiating prominent teeth; cavity very shallow, with an irregular surface, the upper margin angular; within pearly and iridescent.

Two valves of this species are in Dr. Spillman's collection, which are both broken

off as represented in the figures, but the remainder perfectly preserved, and the hinge is as entire as that of a recent bivalve. It differs from *G. solenoides*, in having an anterior wing with a truncated margin; in being much more compressed, and in having an uninterrupted series of prominent cardinal teeth, &c.

#### CTENOIDES, *Klein*.—*LIMA*, *Brug*.

CTENOIDES ACUTILINEATA. Pl. 34, fig. 2. Oblong, oblique, very thin; posterior side radiated with acute, prominent lines, thirteen to fifteen in number; anterior side with minute, close, radiating lines; surface concentrically wrinkled; posterior margin sub-rectilinear.

This somewhat resembles *L. Wacoensis*, Roemer, in outline, but it is less ventricose, and has radiating lines, whilst the other is costate.

Klein founded this genus on the shell known as *Lima glacialis*, and the *L. scabra* is the type of his genus RADULA.

#### INOCERAMUS, *Parkinson*.

1. INOCERAMUS ARGENTEUS. Pl. 34, fig. 16. Obliquely suboval, very thin, smooth, inflated anteriorly; umbo prominent; summit elevated; lines of growth towards the posterior margin assume the form of squamose striæ; anterior side very short; margin obtusely rounded.

2. INOCERAMUS COSTELLATUS. Pl. 34, fig. 12. Obliquely subovate, ventricose; radii slightly prominent, rounded, close, disappearing posteriorly, obsolete towards the anterior margin; concentric acute lines ornament the surface; anterior side very short, obtuse; umbo and beak of larger valve very prominent.

This species is marked exteriorly like a PHOLADOMYA, but is inequivalve, with the hinge of an INOCERAMUS. The specimen is distorted.

Species of this genus were figured by Klein in 1770, under the generic names of SPONDIOLITHOS, MUSCULITES and PHOLADIS.

#### OSTREA, *Lin*.

OSTREA PECULIARIS. Pl. 34, fig. 7. Oblong or elliptical, thin, ventricose along the middle and depressed on the sides; surface with radiating wrinkles; margins towards the apex denticulated.

A thin and abundant species remarkable by the tuberculated or denticulated margins and elongated trilobe shape.

2. OSTREA CONFRAGOSA. Pl. 34, fig. 4. Very irregular; rather thin; lower valve profoundly ventricose, with deep irregular cavities or depressions.

The lower valve only is known, and is very unlike any other Cretaceous species in the United States.

4. *OSTREA DENTICULIFERA*. Pl. 34, figs. 1 and 8. Irregular, moderately thick, indented, but not plicated; upper valve flattened; hinge area wide, with a transverse ridge at the base of the fosset; lower valve moderately capacious; upper margins denticulated; muscular impressions large.

#### EXOGYRA, *Say*.

*EXOGYRA INTERRUPTA*. Pl. 34, fig. 15. Adhering, thin; lower valve with interrupted radiating costæ; upper valve entire, with a thickened margin.

A small species. The lower valves in all the specimens adhere to other shells and nearly conceal the exterior character.

#### PULVINITES, *Defrance*.

*PULVINITES ARGENTEA*. Pl. 34, fig. 5. Transversely subovate, compressed; perforated valve slightly concave; foramen oval, from its upper margin a channel extends to the apex; substance of shell silvery, thin; cardinal plate broad, with about thirteen radii or teeth; the lower valve presents within the appearance of two muscular impressions, the one above the other, the former striated.

The present species of this rare genus is allied to *P. Adansonii*, but differs from the figures of that species in having a broader hinge plate, and much less curvature of the posterior margin. It closely resembles an *ANOMIA* exteriorly. *P. Adansonii* characterises the Upper Cretaceous rocks of Europe.

#### ANOMIA, *Lin*.

*ANOMIA SELLÆFORMIS*. Pl. 34, fig. 6. Suborbicular, with a short fold anteriorly towards the hinge line; posterior side with a profound plication.

Length  $\frac{3}{8}$  inch.

There is but one valve of this species in Dr. Spillman's collection, and perhaps other specimens may exhibit a considerable variation from the saddle-shape character.

#### GASTEROPODA.

##### STROMBUS, *Lin*.

*STROMBUS DENSATUS*. Pl. 35, fig. 14. Lip expanded, very thick; costæ disappearing on the middle of the volution; labrum suddenly thickened, with a groove behind the raised margin; a calcareous deposit sometimes coats the whole shell, rising into an oblique, thick, prominent ridge, the upper margin of which is on a line with the apex.

##### APORRHAI, *Petiver*.

*APORRHAI DECEMLIRATA*. Pl. 35, fig. 11. Spire elevated, acute; volutions nine, convex, longitudinally costate, and finely striated transversely; ribs distant, promi-



nent, angular, acute, short on the back of the body volution, but extending in front to a carinated line which borders the labrum; transverse striæ distinct at base; labrum extended into the rostrum above the middle, where it is angulated and subcarinated and channelled within.

The beak is broken as well as the rostrum of the outer lip, but otherwise the only specimen in the collection is very well preserved.

#### HARPAGO, *Klein*.—PTEROCERA, *Lam*.

HARPAGO TIPPANUS. Pl. 35, fig. 25. A fragment, with smooth subangulated volutions, a carinated line revolving at the base of each; rostrum of the labrum profoundly extended, trilobate, the central and upper lobe profoundly carinated in the middle; substance of the shell thin.

The labrum has evidently been extended above the apex, but only a slight trace of it remains near the upper part of the spire. The specimen is evidently a young or immature shell.

#### RIMELLA? *Agass*.

RIMELLA CURVILIRATUS. Pl. 35, fig. 9. Fusiform, ribbed longitudinally; ribs somewhat curved, slightly sinuous, about twenty-three in number on the body volution; interstices transversely striated; beak produced?

#### CONUS, *Lin*.

CONUS CANALIS. Pl. 35, fig. 22. Spire prominent, volutions profoundly angular in consequence of a deep channel revolving at the suture.

A very remarkable species, in its profoundly channelled suture presenting a strong contrast to more modern fossil or recent cones.

#### DRILLIA, *Gray*.

1. DRILLIA NOVEMCOSTATA. Pl. 35, fig. 13. Subfusiform, spire elevated; volutions scalariform, having distant, wide, prominent, rounded slightly oblique costæ, terminating above at a crenulated line which borders the suture; body volution with short, very prominent, tuberculiform, thick ribs; revolving lines obsolete above, prominent and alternated inferiorly.

2. DRILLIA? TIPPANA. Pl. 35, fig. 5. Subfusiform, with thick, rounded, smooth, longitudinal ribs on the body volution, each tuberculiform at the summit; ribs of the spire tuberculiform at base, or interrupted in the middle; base with thick, prominent revolving lines.

TURRIS, *Rumphius*.—PLEUROTOMA, *Lam.*

TURRIS RIPLEYANA. Pl. 35, fig. 21 and 29? Elongated, slender; spire subequal in length to body volution and beak; volutions ribbed longitudinally; ribs slight and somewhat curved above, where they are interrupted by a deep revolving furrow, which causes the appearance of a prominent line bordering the suture; surface of shell with revolving lines distinct on the body whorl and beak.

FUSUS, *Klein.*

FUSUS NOVEMLIRATUS. Pl. 35, fig. 18. Elongated; spire elevated, acute; volutions seven; longitudinally costate and transversely striated, ribs thick, prominent, rounded; suture margined by crenulated line; body volutions having about nine distant, very large rounded costæ which become obsolete about the middle of the volution; inferiorly marked with longitudinal lines or furrows; beak slender, elongated, sinuous.

## Subgenus AFER.

FUSUS BELLALIRATUS. Pl. 35, fig. 17. Fusiform, spire prominent, acute; volutions of spire seven, subscalariform; tuberculated inferiorly and ornamented with revolving lines; body volution ribbed longitudinally, and having prominent transverse, robust lines, which on the ribs assume a tubercular aspect; beak elongated.

This shell is referred to a subgeneric division of which *Fusus afer*, *Lam.*, may be regarded as the type.

PYRIFUSUS, *Conrad.*

Pyriform; columella broad, thick, flattened; body volution transversely oval.

PYRIFUSUS SUBDENSATUS. Pl. 35, fig. 12. Subpyriform; spire short, subscalariform, volutions four? longitudinally ribbed and spirally lineated, lines minute; body whorl wide, contracted above where there are longitudinal wrinkles and revolving lines; below are prominent ribs becoming obsolete about the middle, and prominent, revolving lines over the whole surface below the shoulder.

FICUS, *Klein.*

FICUS OCTOLIRATUS. Pl. 35, fig. 6. Pyriform; spire conical; costæ of body volution about eight in number, inclined to be square, distant; beak long and slender.

RAPA, *Klein.*

RAPA SUPRPLICATA. Pl. 35, fig. 20. Pyriform; spire depressed, volutions flattened above; summits ornamented with oblique, curved striæ or grooves.

A very much broken specimen, but the fragment exhibits marked characters. It is a very ventricose, smooth species, easily recognised by its flattened volutions and curved lines.

VOLUTILITHES, *Swainson*.

VOLUTILITHES CRETACEA. Pl. 35, fig. 16. Fusiform; spire elevated; volutions contracted beneath the suture, irregular longitudinal ribs on the upper volutions.

Length of fragment  $2\frac{1}{2}$  inches.

Another less perfect specimen has been a much larger shell. This species bears some resemblance to *Voluta Lamberti*, of the British Miocene. A young specimen which is figured in outline has a very acute spire and minute revolving lines. The columella being imperfect, the plaits have not been observed. The base is narrow, produced and but slightly emarginate.

CHEMNITZIA, *D'Orbigny*.

1. CHEMNITZIA INTERRUPTA. Pl. 35, fig. 15. Spire prominent, scalariform, profoundly costate longitudinally; ribs interrupted below the suture by a deep furrow; base with rather distant, revolving lines.

Columella and base imperfect; therefore this and the following shell are only provisionally referred to CHEMNITZIA.

2. CHEMNITZIA DISTANS. Pl. 35, fig. 30. Short—subfusiform; spire prominent, subscalariform; volutions four, reticulated; body volution with longitudinal, distant ribs intersected by distant, prominent, revolving lines; columella profoundly curved near the middle.

TRICHOTROPIS, *Sowerby*.

TRICHOTROPIS CANCELLARIA. Pl. 35, fig. 8. Acutely subovate; volutions five; spire subscalariform; body whorl ventricose; longitudinal ribs narrow, prominent, distant; revolving lines prominent, distant, with an occasional minute intermediate line; columella profoundly incurved; labium reflected; base subumbilicated; shoulder of body volution with minute revolving lines, and one larger than the others.

TURRITELLA, *Lam.*

1. TURRITELLA TIPANA. Pl. 35, fig. 19. Subulate; sides straight; volutions carinated with revolving lines, two on each volution larger than the others, remote, one nearly equal in size, nearly medial, and three other fine lines; whorls of spire slightly carinated at base.

2. TURRITELLA ALTILIS. Broad at the base, rapidly narrowing, apex very acute; volutions about eighteen, sides straight, costæ four, in pairs, two upper pair more approximate, and smaller than the inferior pair; three on the lower part of body volution; shell marked with minute revolving lines, the central one between the costæ largest.

Length 3 inches; width of body volution 1 inch.

NATICA, *Lam.*Subgenus LUNATIA, *Gray.*

N. LUNATIA RECTILABRUM. Pl. 35, fig. 28. Subglobose; spire conical, subscalariform; labrum straight in the middle; umbilicus moderate in diameter, profound.

The specimen figured is to the eye as perfect as when first entombed in the Cretaceous ocean's bed.

SOLIDULUS, *Fischer.*

SOLIDULUS LINTEUS. Pl. 35, fig. 10. Elliptical, with very numerous close revolving lines, most distinct on the inferior half; interstices regularly and elegantly striated transversely.

A beautiful species, but the specimen much distorted, which I have endeavored in the figure to restore to something of its original shape.

The above genus is identical with ACTÆON, *Montfort*, and TORNATELLA, *Lam.*

BULLOPSIS, *Conrad.*

Subglobose; spire depressed; aperture wide; columella biplicate.

The spire in this shell is sunk like that of BULLA. I have seen no other shell resembling this.

BULLOPSIS CRETACEA. Sculpture resembling that of SOLIDULUS, consisting of minute impressed lines; aperture wide in the middle; plaits prominent.

Length  $\frac{1}{2}$  inch; width  $\frac{1}{4}$  inch.

## CEPHALOPODA.

BACULITES, *Lam.*

BACULITES TIPPAENSIS. Pl. 35, fig. 27. Acutely ovate, smooth, with profoundly sinuous lines of growth, which rise on the sides, and curve downwards on the back and front; shell splendidly iridescent; back regularly rounded; front slightly contracted, or with depressed lines on the sub-margin.

This species can be readily distinguished from *B. ovata*, Say, by its acutely ovate outline viewed in a tranverse section. The substance of the shell appears to be in perfect preservation, beautifully iridescent, and the lines of growth run profoundly oblique downwards to the front, which they cross in nearly straight lines. Specimens show the interior free from sand, with the foliated septa as perfect as when the animal inhabitant was alive. In most specimens the front is obtusely carinated as in the following species:

BACULITES SPILLMANI. Pl. 35, fig. 24. Obtusely ovate; back flattened, front a little raised or obtusely carinated; sides with distant, very thick, obtuse, curved, remote ridges.

This is a beautiful species, even more highly iridescent than the preceding. The lines of growth are similar in form to those of the former species but more strongly defined. The septa are too imperfectly exhibited to be defined by a drawing. The substance of shell thin.

Dedicated to its discoverer Dr. W. Spillman.

#### SCAPHITES, *Parkinson*.

SCAPHITES IRIS. Pl. 35, fig. 23. Substance of shell very thin, highly iridescent; whole surface ornamented with pyramidal, distant tubercles, the intervening spaces smooth; back rounded, with two rows of tubercles, another row runs along the junction of the lateral with the dorsal margin; sides flattened.

A fragment of this beautiful species exhibits the extremely thin septa, in perfect preservation and free from sand.

The form of the septa is very unlike that in *S. Conradi*, to which species I referred it in my introductory remarks.

Pl. 35, fig. 31. Outlines of a species of CYTHERINA, *Lam.*, somewhat enlarged. Symmetrical, smooth, subrostrated at each end. *C. tippiana*.

Dr. Spillman has forwarded some fine specimens of Older Cretaceous shells from the vicinity of Columbus; among them is *Nautilus orbiculatus*, Tuomey. This shell is a species of the genus NAUTILITES, of which four species have been found in North America, as follows:

#### NAUTILITES, *Martin, Bronn*.

1. N. VANUXEMI, *Con.* (Pelagus,) Jour. Acad. Nat. Sc., vol. i. N. S. New Jersey.
2. N. (NAUTILUS) ORBICULATUS, *Tuomey*. Proceed. Acad. Nat. Sc. 1845. Mississippi.
3. N. (NAUTILUS) ALABAMENSIS, *Morton*. Synopsis. Pl. 18, fig. 3.
4. N. ANGUSTATUS, *Conrad*. Dana's Geol. Exp., p. 728. Oregon.

No. 1. was supposed to characterise an Eocene deposit, near Long Branch, N. J., but it is more probably Cretaceous.

## REFERENCE TO PLATE XXXIV.

- |                                       |                                     |
|---------------------------------------|-------------------------------------|
| Fig. 1. <i>Ostrea denticulifera</i> . | 10. <i>Gervillia ensiformis</i> .   |
| 2. <i>Otenoides acutilineata</i> .    | 11. <i>Cibota lintea</i> .          |
| 3. <i>Cardium Spillmani</i> .         | 12. <i>Inoceramus costellatus</i> . |
| 4. <i>Ostrea confragosa</i> .         | 13. <i>Dosinia densata</i> .        |
| 5. <i>Pulvinites argentea</i> .       | 14. <i>Dreissena Tippiana</i> .     |
| 6. <i>Anomia sellæformis</i> .        | 15. <i>Exogyra interrupta</i> .     |
| 7. <i>Ostrea peculiaris</i> .         | 16. <i>Inoceramus argenteus</i> .   |
| 8. ——— <i>denticulifera</i> .         | 17. <i>Siliquaria biplicata</i> .   |
| 8 <i>b</i> <i>Cardium Tippianum</i> . | 18. <i>Meretrix Tippiana</i> .      |
| 9. <i>Pholadomya Tippiana</i> .       | 19. <i>Legumen ellipticus</i> .     |

## REFERENCE TO PLATE XXXV.

- |                                              |                                      |
|----------------------------------------------|--------------------------------------|
| Fig. 1. <i>Cucullæa Tippiana</i> .           | Fig. 17. <i>Fusus bellaliratus</i> . |
| 2. ——— <i>capax</i> .                        | 18. ——— <i>novemliratus</i> .        |
| 3. <i>Crassatella Ripleyana</i> .            | 19. <i>Turritella Tippiana</i> .     |
| 4. <i>Nucula percrassa</i> .                 | 20. <i>Rapa supraplicata</i> .       |
| 5. <i>Drillia Tippiana</i> .                 | 21. <i>Turris Ripleyana</i> .        |
| 6. <i>Ficus octoliratus</i> .                | 22. <i>Conus canalis</i> .           |
| 7. <i>Purpuroidea?</i> <i>Ripleyana</i> .    | 23. <i>Scaphites iris</i> .          |
| 8. <i>Trichotropis?</i> <i>cancellaria</i> . | 24. <i>Baculites Spillmani</i> .     |
| 9. <i>Rimella curvilirata</i> .              | 25. <i>Harpago Tippianus</i> .       |
| 10. <i>Solidulus linteus</i> .               | 26. <i>Nucula percrassa</i> .        |
| 11. <i>Aporrhais decemlirata</i> .           | 27. <i>Baculites Tippiensis</i> .    |
| 12. <i>Pyrifusus subdensatus</i> .           | 28. <i>Natica rectilabrum</i> .      |
| 13. <i>Drillia novemcostata</i> .            | 29. <i>Turris Ripleyana?</i>         |
| 14. <i>Strombus densatus</i> .               | 30. <i>Chemnitzia distans</i> .      |
| 15. <i>Chemnitzia interrupta</i> .           | 31. <i>Cytherina Tippiana</i> .      |
| 16. <i>Volutilithes cretacea</i> .           |                                      |

ART. XXI.—*On the Caducibranchiate Uurodele Batrachians.*

By EDW. HALLOWELL, M. D.

CHARACTERS OF THE SUB-FAMILIES.

SALAMANDRIDÆ.

Longitudinal teeth in an undulating series, each in a process of the inner and posterior margin of the elongated vomerine bone. Tongue rather deep, attached in front and posteriorly, free at the sides; no bony bridge above the orbit; ribs rudimentary; parotids very conspicuous; a double series of pores along the median line of the back and tail; a lateral series of porous protuberances on each side; tail round; habits terrestrial. 3 sp.

SEIRANOTIDÆ.

Palatine teeth in two longitudinal rows in the form of a Y reversed; tongue well developed, oblong, rounded in front, broader and almost truncate posteriorly, *free in its posterior half*, less so laterally, attached in front; no parotids; *four fingers and four toes free*; tail slender, long, with a ridge above and below, and also laterally, more or less compressed toward the top; ribs well developed.

*Remarks.*—Differs from *Tritonidæ* especially in the form of the tail, conformation of the ribs, and tongue, which is bound down posteriorly in *Tritonidæ*. 1 sp.

PLEURODELIDÆ.

Head depressed, tongue small, subcircular, *free posteriorly* and at the sides, attached in front; palatine teeth in two longitudinal series, nearly touching anteriorly, diverging posteriorly; a bony arch above the orbit; no distinct parotids; extremities as well as *fingers and toes slender*; tail compressed; a line of small pores on each side, between the axilla and groin; 14 ribs on each side, pointed at the extremity, sometimes perforating the skin; habits aquatic.

*Remarks.*—Related to the *Tritons*; differs from them, chiefly in the length of the ribs, in the tongue being *free posteriorly*, and smaller comparatively; in the com-



paratively larger and depressed head, and long and slender fingers and toes. Two genera. *Pleurodeles* and *Bradybates*.

#### PLETHODONTIDÆ.

Two patches of vomerine teeth behind the internal nares, converging toward each other, but separated by an interval; two longitudinal rows of thickly set sphenoidal teeth, commencing a little behind the palatine, and very closely approximated; tongue broad, oval, well developed; free at its lateral edges, and posteriorly, attached in front; no parotids; body cylindrical, extremities slender; tail rounded, tapering to a point; habits terrestrial. 2 genera. *Plethodon*, *Aneides*. . . 4 sp.

#### BOLITOGLOSSIDÆ.

Head short, flattened, eyes more or less prominent; *tongue of moderate size, mushroom shaped, supported by a central pedicle*; two rows of vomerine teeth, one on each side, immediately behind the inner margin of the internal nares, and two rows of longitudinal sphenoidal teeth, each consisting of a double series, and separated from the first by an interspace without teeth, or continuous with them, and from each other by a well marked interval posteriorly; body slender, cylindriciform; skin smooth; no parotids, or lateral pores; extremities slender; toes free, or one more or less palmated. Four gen.: *Spelerpes*, Raf., *Pseudotriton*, Tsch., (*Mycetoglossus*, Bib.) Am., *Batrachoseps*, (Am. and Europ.), *Geotriton*, Bonap., (Europ.) 4 sp. (3 Am., 1 Europ.)

#### AMBYSTOMIDÆ.

Head large, convex, palatine teeth in a transverse row across the palate, either straight or more or less angular, tongue ovate, moderately free at edges, slightly so in front, attached posteriorly; no sphenoidal teeth; tail more or less compressed. 3 gen.: *Ambystoma*, *Xiphosoma*, (Am.), *Onychodactylus*, (As.) 13 sp.

#### TRITONIDÆ.

Tongue fleshy, papillose, well developed, *attached in front and behind, free at the edges*; palatine teeth in two longitudinal series, approximated and almost parallel, (*Cristatus*, Europ.) or closely in contact in front, diverging posteriorly, (*Diemyctylus*, Am.) so as to leave a triangular interspace; no trace of transverse vomerine teeth; in some genera a bony bridge above the orbit, (*Euproctus*, *Diemyctylus*); no intermaxillary bone as in *Salamandra*, (Meckel); body smooth or granular; head smaller than middle portion of body; tail compressed; ribs rudimentary. 4 gen.: *Euproctus*, (Europ.), *Taricha*, Gray, (Am.), *Triton*, (Europ.), *Diemyctylus*, (Am.)

ELLIPSOGLOSSIDÆ. D. & B.—MOLGIDÆ, *Merrem*.

*Tongue oblong, oval, free at the sides only*; palate provided with small teeth, disposed in two longitudinal rows, in contact *posteriorly*, separated in front in the form of a V, of which the free extremities are directed outward; two flattened parotids; fingers and toes 4—5, free, short; tail stout, much compressed. 1 gen., 1 sp., (As.)

## HEMIDACTYLIDÆ.

Four fingers and four toes; tongue oval, *attached in front, and along the middle more free posteriorly*; two rows of palatine teeth, beginning each in a line, with the internal border of the posterior opening of the nares, extending behind it, and converging toward each other, and two rows of sphenoidal teeth, separated from the first by an interspace without teeth, and from each other by a wide interval, nearly parallel; fingers and toes united at base by a membrane, that of the fingers scarcely visible; fingers and toes short and stout. 1 gen., 1 sp., (Am.)

Gen. SALAMANDRA.\* *Wurfbain, Laurenti*.

*Char.*—Two parotids or glandular protuberances, pierced with numerous pores, very distinct; a double row of pores upon the back and tail; a lateral series of porous protuberances, one on each side; “four fingers and five toes to the extremities, tail rounded and conical;” angular fold; tongue discs oval, or subcircular, free only at its edges, “slightly posteriorly, at least when retracted;” two longitudinal series of teeth more or less arched.

SALAMANDRA MACULOSA, *Laurenti*.

*Char.*—Body black, skin smooth, with large yellow blotches, irregularly disposed upon the head, the back, the sides, the extremities and the tail; large parotid glands, yellow for the most part, pierced with numerous pores very distinct; about 60 teeth in the upper and as many in the lower jaw, and 40 palatine, (giebel.) Length 5½ inches, (Fr.)

Duméril and Bibron make three distinct varieties of this species, based upon the differences in the arrangement of the yellow blotches. T. ix., p. 57. Of twelve specimens, however, which we have examined, no two are marked alike.

*Habitat.*—France, (Normandy, Picardy, and some provinces of the S. W. of France,) Germany, Hungary, Austria, Turkey, Spain, Italy, N. Africa. Found

\*Ety.—Σαλαμάνδρα, Greek first used by Aristotle; according to Wurfbain, σάντος humid, or Σαλαμάνδραν, an animal that rests tranquilly in its retreat. Quæta in Spelunca, see Dum. & Bib., t. ix., p. 50.

under stones, at the bottom of old walls, ditches, avoiding the heat of the sun; comes out during the rain or at night; stupid, timid; feeds on flies, worms, young snails, scarabæi, lumbrici, ovo-viviparous.

For synonym. see Dum. & Bib., t. ix., p. 52, 53, 54. 14 specimens in Mus. Acad. Nat. Sci.; 11 Dr. Wilson, Bonap. collection; 1 Dr. Green; 2 Garden of Plants.

2. SALAMANDRA CORSICA, *Laurenti*.

*Char.*—Body black, with numerous yellow spots, of different dimension irregularly disposed upon the head, the back, sides, tail and extremities; palatine teeth more closely approximated than in *Maculosa*, in a considerable part of their extent running nearly parallel, but arched in front, leaving a small intermediate circular space. Length  $5\frac{1}{2}$  inches, (Fr.)

*Habitat.*—Corsica, Algeria, Sardinia. Two specimens in Mus. Acad. N. S. Dr. Wilson, Bonaparte Collection.

3. SALAMANDRA ATRA, *Laurenti*.

*Char.*—Entirely black without any spots; much smaller than either of the preceding species. Length  $4\frac{1}{2}$  inches.

*Habitat.*—Alps, near the snow, Austria, Carinthia, Carniola, Styria, Upper Italy. Gives birth to but two young at a time.

Five specimens Mus. Acad. N. S. Two Dr. Wilson, Bonap. Col. Two Dr. Hallowell. One Dr. Harlan.

SEIRANOTA, *Barnes*.

M. Bonap. Fauna Italica, 1839. *Salamandrina*, Fitzinger, 1826.

*Char.*—Tongue oblong, entire, rounded in front, broader and almost truncate posteriorly, free in its posterior half, less so laterally, attached in front. Palate furnished with small teeth, disposed in two longitudinal lines, in the first half of their course touching in front, then separating in the form of a Y inverted ( $\overline{\chi}$ ), or forked posteriorly; no salient parotids; four fingers and four toes free: eyes lateral; tail slender, rounded at base, long and tapering; below a smooth longitudinal ridge in the middle; skin thickly granulated.

SEIRANOTA PERSPICILLATA, *Fitz.*

*Char.*—Black; a triangular spot upon the head, of a reddish yellow color; the two anterior extremities directed toward the eyes; the belly whitish, with black spots; a large black spot upon the throat; under part of extremities and tail of a vermillion red color. Length 2 inches and 7 lines.

*Habitat.*—Italy (Tuscany, Sardinia.)

Two specimens in Mus. Acad. N. S. Dr. Wilson, Bonap. Col.

PLEURODELES, *Michællès*.

*Char.*—Head depressed; tongue small, rounded, covered with papillæ entirely posteriorly and upon the sides, attached in front, adherent in the middle; pterygo-palatine teeth in two longitudinal series, nearly touching anteriorly, extending a considerable distance anteriorly beyond the internal nares, diverging so as to leave a wide intermediate space, much broader posteriorly; maxillary teeth small; a bony arch above the orbit; parotids porous; extremities slender as well as fingers and toes; first toe shorter than fifth; skin granular; tail compressed; longer than body; 14 pointed ribs on each side, sometimes perforating the skin.

PLEURODELES WATLI, *Michællès*.

*Char.*—Brown above, with numerous dark colored spots, and a series of white specks, or orange colored small round spots on each side. Length  $4\frac{1}{2}$  inch. (Fr.)

*Habitat.*—Tangier, Andalusia, neighborhood of Chiclana, S. Spain.

One adult specimen in Mus. Acad. Nat. Sc. and two young (*Bradybates poireti* and *Triton nycthemerus*) Dr. Wilson, Bonap. Collection.

*Gen. Remarks.*—Pleurodeles is related to the Tritons, but differs from them in its large flattened head, its lengthened ribs, its long tail; the nares are more widely separated than in the Tritons, the eyes more elliptical, the upper eyelid more developed, according to Michællès. (Isis, 1830, p. 191.) The parotids are also wanting in the Tritons. *P. Watli* is found abundantly in cisterns near Cadiz, in the south of Spain. We have in the collection of the Academy a single specimen, labelled *Triton nycthemerus*, belonging to the Bonap. Collection, which is without doubt the young of *Pleurodeles Watli*. Gray observes that it is, perhaps, the young of *T. marmoratus* or *Triton cristatus*, but the teeth are arranged as in *Pleurodeles* and not as in *Triton*, and the tongue is also that of *Pleurodeles*, which is quite different from the tongue of *Triton*.

BRADYBATES, *Tsch.*

*Char.*—Head round, occiput swollen, but the forehead depressed; eyes small and far apart; feet very short, toes small, but free throughout; body short, broad, the sides, as in *Pleurodeles* pierced by the ribs; tail shorter than the body, broad at the base, roundish, towards the end more angular, differing remarkably from *Pleurodeles*, inasmuch as the latter has a very long sword-like tail; tongue small, rounded like a firmly attached wart; no parotids; at the root of each foot two tolerably large swellings. (Tschudi.)

\* πλῆυρος side, δηλῆιος, injurious. (Michællès, Isis, tom. xiii.)

## BRADYBATES VENTRICOSUS.

*Char.*—Dark brownish yellow, with dark colored spots, and thickly covered with fine warts. Length —.

*Habitat.*—Spain.

*Gen. Remarks.*—Duméril and Bibron are inclined to the opinion that this genus may be only the young of *Pleurodeles*, coming from the same localities and possessing many of its characters. “We have in the Bonaparte Collection, now belonging to the Academy of Nat. Sciences, a single specimen marked *Bradybates poireti*, which is evidently a young *Pleurodeles*, but the tail is longer than the body.” Tschudi says “Zahne ganz Plethodon,” but this is probably an error.

PLETHODON, *Tschudi*.PHATNOMATORHINA, *Bibron*, fide Bonap.

*Char.*—Head of moderate size, depressed, eyes less prominent than in *Spelerpes*, tongue broad, oval, free at its lateral edges, and posteriorly attached in front; two patches of vomerine teeth behind the internal nares, converging toward each other, but separated by an interval; two longitudinal rows of thickly set sphenoidal teeth,\* commencing a little behind the palatine, and very closely approximated; maxillary teeth very small; no parotids; body cylindrical, extremities slender; tail rounded, tapering to a point; longer than head, neck and body; four fingers, five toes. Am.

## PLETHODON GLUTINOSUS.—(Grey spotted Salamander.)

*Char.*—Above bluish black, with minute white spots; these spots much larger and confluent upon the flanks, and sides of neck and cheeks. Length 8 inches 10 lines.

*Habitat.*—Massachusetts, Pennsylvania, Florida, Virginia, North and South Carolina, Georgia, Alabama and Louisiana.

Specimens in Mus. Acad., presented by Dr. Wilson, (Bonap. coll.,) Dr. Griffith, Dr. Leidy and Dr. Hallowell.

Habits terrestrial, quite active, found under rocks and stones.

*Syn.* 1838. *P. glutinosus*, Tschudi, Classif. der Batrach., p. 92, No. 5.

1818. *Salamandra glutinosa*, Green, Journal Academy Natural Sciences, vol. i. p. 2, pl. 357.

1838. *Salamandra glutinosa*, Schlegel, Fauna Japonica, p. 118.

1827. *Salamandra glutinosa*, Harlan, Journal Academy Nat. Sci., vol. v., p. 330.

\* Teeth arranged upon the basi-sphenoidal and basi-occipital bones, to the number of 300 and upwards, resembling the dental system of the highly organized clupeoid fishes of North America; a single row of transverse teeth along the vomer cover.

1838. *Salamandra glutinosa*, Holbrook, N. American Herpetology, 1st ed., vol. ii., p. 129, pl. 30.
1842. *Salamandra glutinosa*, Holbrook, N. American Herp., 2d ed., vol. v., p. 39, pl. 10.
- Salamandra granulata*, Holbrook, vol. v., p. 54, (var.)
1840. *Salamandra glutinosa*, Storer, Rep. Reptil. Mass., p. 252.
1842. *Salamandra glutinosa*, Dekay, Natural History of New York, Reptiles, p. 81, pl. 17, fig. 142, (very young.)
1818. *Salamandra variolata*, Gilliams.
1827. *Salamandra cylindracea*, Harlan, Journal Academy Nat. Sci., vol. v., p. 328.
1835. *Salamandra cylindracea*, Harlan, Med. and Phys. Researches, p. 94.
1835. Bonap. Fauna Italica ii., p. 139; Fitzinger, Syn. Rept., p. 32.
1827. *Salamandra Jeffersoniana*, Contributions to Maclurian Lyceum, No. 1, p. 4, pl. 1, fig. 1.
1850. *Ambystoma Jeffersoniana*, Baird, Journal Academy Nat. Sci., vol. i., p. 283; (*exclus. Salamandra Jeffersoniana*, Schlegel; *Ambystoma ingens*.)
1850. *Plethodon glutinosum*, Gray, Cat. Br. Mus., Amphib., p. 39.
1854. *Plethodon variolosum*, Dum. & Bib., Erpet. generale, t. ix., p. 83.
1854. *Cylindrosoma glutinosum*, Dum. & Bib., Erpet. generale, t. ix., p. 80.

*Gen. Remarks.*—The coloration varies somewhat in different specimens. Of 25, now before me, recently captured at Altoona, Pa., about 225 miles from Philadelphia, by Dr. Wilson, Dr. Leidy and Mr. Conrad, I find that the young are much more thickly spotted than the adults, which above present the confluent appearance of the spots upon the sides; the abdomen and under part of the tail are bluish, sometimes very minutely spotted with white, that part of the tail usually so; the upper part of the head is generally free from spots, but a large one may often be seen upon the skin; palms of soles of feet brick-dust red. Some of these specimens have a decidedly granulated appearance, and are covered all over upon the back with very minute white spots interspersed between the larger ones. The specimens from South Carolina and Georgia present no differences in the coloration; but among those of the former is a marked variety noticed by Dr. Holbrook, entirely black above without spots; chin and throat yellowish; abdomen dark brown, sometimes minutely white spotted.

PLETHODON ERYTHRONOTUS.—(Red-backed Salamander.)

*Char.*—Body cylindrical, with a broad red,\* reddish brown or dusky yellow, or pink colored vertical band, extending from the occiput to the end of the tail; flanks cinereous; abdomen and under parts of extremities greyish; chin white with a tinge

\* This reddish band is often marked with brown.

of red; tail cyclo-tetragonal at base, shorter than in *glutinosus*; 15 costal folds; 20 folds upon the tail. Length 2 inches 8 lines.

*Habitat*.—Massachusetts, Pennsylvania, Virginia, abundant near Philadelphia, Cresson, Pa.; a land animal, found under stones and logs of wood.

29 specimens in Mus. Acad. Nat. Sci., presented by Mr. F. Hill, Dr. Pickering, Dr. Bache, (Green collection.)

#### PLETHODON NIGER.

*Char*.—Black or dark brown above, with numerous black spots; black upon the sides, with numerous small white spots thickly agglomerated; abdomen purplish, more or less marbled with black and grey; throat, neck and abdomen thickly spotted with minute white spots; tail of moderate length, somewhat longer than head, neck and body, in some specimens a little shorter, rounded at base, compressed at tip. Length 4 inches 4 lines.

*Habitat*.—Very common in Massachusetts, Pennsylvania, (abundant in the neighborhood of Philadelphia,) Cresson, North Carolina, Ashville, Georgia, Louisiana.

40 specimens presented by Dr. Bache, (Green collection,) Dr. Hallowell, Dr. Leidy, Dr. Uhler, Dr. Wilson.

#### PLETHODON AURICULATUM.

*Char*.—Head small, with a reddish brown spot, near the ear; body cylindrical with a series of minute reddish brown spots on each side; tail rounded at base, compressed posteriorly (in alcohol); sphenoidal less thickly agglomerated posteriorly than in other species of *Plethodon*. Length 5 inches.

*Habitat*.—Riceboro', Georgia, South Carolina.

3 specimens in Mus. Acad., presented by Dr. Jones and Prof. Holbrook.

#### ANEIDES, *Baird*.

*Char*.—Head large, swollen at the temples, snout angular, eyes very prominent, tongue obcordate, attached in front, and along the middle, sides quite free, free also posteriorly, but less so than at the sides, maxillary teeth greatly developed, especially those of the lower jaw, which are spear-shaped, sharp pointed, more or less convex anteriorly, concave posteriorly, with a ridge in the middle, about three-fourths of a line in length; transverse palatine teeth in two small incurvated rows behind the internal nares, meeting posteriorly; sphenoidal teeth thickly set in two rows, sharp pointed, closely in contact in anterior third, posteriorly a very narrow interspace not enlarged behind; extremities slender; fingers and toes lightly compressed, free; first finger much shorter than fourth, second than third; first toe much shorter than fifth, second than third, third and fourth of equal length; skin smooth; costal grooves well



marked, twelve or thirteen in number; tail round, tapering to a point, very slightly compressed at tip, about same length as head, neck and body.

ANEIDES LUGUBRIS.

*Char.*—Color dark olive above, yellow below without spots, or other markings; a row of small round spots on each side. Length  $4\frac{1}{2}$  inches.

*Syn.* *Salamandra lugubris*, Hallowell, Proceedings Academy Natural Sciences, vol. ?

*Habitat.*—San Francisco.

2 specimens in Mus. Acad. Nat. Sci., presented by Dr. Townsend, and Dr. Heermann.

SPELERPES, *Raf.*—CYLINDROSOMA, *Tschudi.*

*Char.*—Head short, flattened, snout rounded, eyes very prominent, pupil oblong, horizontal, tongue of moderate size, bolitoglossal, two rows of palatine teeth, one on each side immediately behind the inner margin of the internal nares, and two rows of longitudinal sphenoidal teeth, separated from the first by an interspace without teeth, and from each other by a well marked interval; body slender, cylindriciform; skin smooth, extremities and fingers and toes slender; the latter perfectly free; tail very long and tapering, cyclo-tetragonal at base, compressed but not considerably in the greater part of its extent. N. Am.

SPELERPES LONGICAUDA.

*Char.*—Body cream colored above, with numerous dark colored irregularly shaped spots; under parts yellowish white; tail very long with transverse black bands upon the sides.

*Habitat.*—Massachusetts, N. Jersey, Pennsylvania, near Philada., Cresson, Kentucky, (Mammoth Cave.)

Five specimens in Mus. Acad. Two Bonap. collection, Dr. Wilson.

*Syn.* 1818. *Salamandra longicauda*, Green, Journal Acad. Nat. Sci., Philada., vol. i., p. 351.

1832. *Spelerpes lucifuga*, Rafinesque, Atlantic Journal, p. 22.

1835. *Salamandra longicauda*, Harlan, Medical and Physical Researches, p. 96.

1838. *Cylindrisoma longicauda*, Tschudi, Classif. der Batrachier, p. 93, No. 6.

1842. *Salamandra longicauda*, Holbrook, N. Amer. Herp., p. 61, pl. 19.

1842. *Salamandra longicauda*, Dekay, Natural History of New York, p. 78, pl. 17, No. 41.

1843. *Saurocerus longicauda*, Fitzinger, Synop. Reptil., p. 34.

1850. *Spelerpes longicauda*, Baird, Journ. Acad. Nat. Sci., vol. i., p. 287.

1850. *Spelerpes longicauda*, Gray, Cat. Br. Mus., p. 43, gen. 9, No. 1.

1854. *Cylindrosoma longicaudatum*, Duméril and Bibron, t. ix. p. 78.

SPELERPES GUTTO-LINEATA.

*Char.*—Body pale straw color above, with a vertical line of black, bifurcating behind the occiput; a lateral black band with a row of small white spots along its middle, edged with white; tail longer than head, neck and body; under parts dark grey.

*Syn.* 1842. *Salamandra gutto-lineata*, Holbrook, Gray, vol. v. p. 29

1854. *Cylindrosoma gutto-lineatum*, Dum. & Bib., t. ix. p. 79.

*Habitat.*—South Carolina.

SPELERPES BI-LINEATA.—(Striped-back Salamandra, *Dekay*.)

*Char.*—Head small, body cylindrical, tail longer than body, and slightly compressed toward the tip; color above brownish yellow, with numerous small black spots; a black lateral line on each side; belly and under parts of tail, extremities, chin and throat yellow.

*Habitat.*—Massachusetts, Jersey, North Carolina, Pendleton, South Carolina, and neighborhood of Philadelphia, where it is abundant. Length 3 inches 10 lines.

Specimens in Mus. Acad.

*Syn.* *Salamandra bi-lineata*, Green, Journal Academy of Nat. Sci., vol. i. p. 325.

*Salamandra flavissima*, Harlan, Medical and Physical Researches, p. 97.

1842. *Salamandra bi-lineata*, Holbrook, N. American Herpetology, vol. v. p. 55.

Specimens in Mus. Acad., Nat. Sci., 4, Green collection, Dr. Bache.

A number of the larvæ of this species were caught near the falls of Schuylkill, August 7th, 1856, by Dr. Leidy, and presented the following appearances: a broad yellow band along the back, back spotted, sides greyish brown with a longitudinal row on each side, of minute subround yellow spots; under parts white without spots; eyes latero-superior, large and prominent. These specimens are from 9 lines to 2½ inches in length. August 15th, a specimen fully grown; tail quite long; no gills; captured under a stone very near the water.

SPELERPES CIRRIGERA.

*Char.*—"Head short, snout rounded, two barbels to the upper jaw, between the nostrils and lip; body above pale yellow, mottled with black points, and a dusky lateral line; tail compressed, longer than the body."—Holbrook. Length 3 inches 2½ lines.

*Syn.* *Salamandra cirrigera*, Green, Journal Academy Nat. Sci., vol. iv. p. 253.

*Salamandra cirrigera*, Harlan, Medical and Physical Researches, p. 99.

*Habitat*.—Louisiana and Mississippi.

We have never seen this animal.

SPELERPES HALDEMANNI.

*Char*.—Head flattened above, snout rounded; body and tail yellow above, slightly olive at the flanks, marked with dusky spots and blotches, disposed somewhat in thin irregular longitudinal series."—Holbrook. Length 4 inches.

*Syn*. 1842. *Salamandra Haldemanni*, Holbrook, N. American Herpetology, vol. v. p. 59.

*Habitat*.—Pennsylvania, Maryland and Virginia.

We have never seen this species, but Dr. Holbrook states that he has received specimens from each of the above mentioned States.

PSEUDOTRITON, *Tschudi*.—MYCETOGLOSSUS,\* *Bibron*.

*Sp. Char*.—Palatine and sphenoidal teeth in a continuous series, (4 rows, Owen,) longitudinal series closely approximated in their anterior third, then diverging, leaving an interspace in the shape of a V inverted, the extremities much prolonged; tongue of moderate size, subround, *bolitoglossal*; first toe much shorter than fifth, third and fourth of nearly equal length; body rather long, cylindrical; tail of moderate length.

PSEUDOTRITON RUBER.—(The Red Salamander.)

*Char*.—Head short, snout rounded; eyes prominent; above red with numerous subround small black spots, smaller upon head and tail; abdomen and under parts of tail in some specimens immaculate; in others covered as well as throat with very minute black points; flanks red spotted, spots much smaller than upon the back. Length  $5\frac{1}{4}$  inches.

*Habitat*.—From Massachusetts to Florida, but not west of Alleghany mountains; quite abundant in neighborhood of Philadelphia. A specimen from Cresson, Pa., 235 miles west of Philadelphia. Specimens in Charleston College from Abbeville, South Carolina.

*Syn*.—*Pseudotriton montanus*, Baird, Journal Academy Natural Sciences, vol. i. p. 293.

Specimens in Mus. Academy Natural Sciences, presented by Dr. Wilson, Dr. Bache, Dr. Hallowell and Dr. Uhler.

PSEUDOTRITON SALMONEA.

*Char*.—Head large, flat, snout obtuse, truncate, with a salmon colored line on each

\* *μυκης* mushroom, and *γλωσσα* tongue.

to the orbits; body and tail yellowish brown above; salmon color with a tinge of yellow at the sides; internal nares very large; body long, cylindrical; tail rounded at base, compressed laterally, longer than body. Length  $6\frac{1}{2}$  inches.

*Habitat*.—Pennsylvania and Massachusetts. 1 specimen.

#### BATRACHOSEPS, *Ch. Bonap.*—(Fauna Italica.)

*Char.*—*Tongue bolitoglossal, supported upon a long and narrow pedicle*; two bunches of palatine teeth, each commencing just behind the posterior opening of the nostrils and on a line with its internal border. Two rows of sphenoidal teeth separated from the first by an interspace without teeth; head very short, eyes prominent, skin smooth, body and tail elongate, slender, roundish, plaited on the sides, limbs slender, far apart; toes 4—4, short, slender, free.

*Remarks.*—This genus differs from *Salamandrina*, which has also 4 fingers and 4 toes, in the arrangement of the teeth and shape of head and form of tongue, and from *Hemidactylum*, which has also 4 fingers and 4 toes, in the shape of the head and especially in the mode of attachment and shape of the tongue.

#### BATRACHOSEPS ATTENUATUS.

*Char.*—"Blackish brown; back and upper part redder, with a black dorsal line and diagonal cross lines; body and tail elongate, slender, round; feet very small, thin; toes free."—Gray. Length 3 inches 7 lines; tail 2 inches 1 line.

*Habitat.*—San Francisco. One specimen in Mus. Acad., Bonap. collection, presented by Dr. Wilson.

#### BATRACHOSEPS QUADRIDIGITATUS.

*Char.*—Pale straw color, with a few minute dark brown spots or vertebral lines; flanks marked with an irregular series of dark brown spots; abdomen bluish silvery white; head large, tail very long.—Holbrook. Length 3 inches 4 lines.

*Habitat.*—South Carolina, Georgia and Florida.

Habits terrestrial; found under decayed or fallen trees; comes out only after rains or in the dusk of the evening; feeds on insects.—Dr. Holbrook. 2 specimens in Mus. Acad., presented by Dr. Jones.

#### GEOTRITON,\* *Ch. Bonaparte.*

*Char.*—*Tongue bolitoglossal*; two patches of palatine teeth, one behind each of the internal nares, the convexity presenting forward; several rows of sphenoidal teeth, separated from the palatine by a considerable interval, (about a line,) and from each

\**gē* land, and *triton* triton.

other, leaving a wide interspace; eyes prominent; no parotids; the fingers and toes palmated at base; skin smooth; tail of moderate length.

GEOTRITON\* FUSCUS.

*Char.*—"Brown with reddish lines almost effaced; ash color below, with small white points; tail a little shorter than the body, large at its base and almost round; fingers short, slightly palmated and depressed."—D. & B. Length  $3\frac{1}{2}$  inches.

*Habitat.*—Appenines, Sardinia, Tuscany, Spain, Southern Italy. 4 specimens Mus. Acad., Dr. Wilson, Bonap. collection.

AMBYSTOMA, *Tschudi*.

*Char.*—Head large, thick, convex, palatine teeth in a transverse row, passing entirely across the palate, behind the internal nares, nearly straight, (*tigrinum*,) irregular, interrupted, forming three distinct patches, (*fasciatum et laterale*,) obliquely triangular, the apex forward, (*nebulosum*,) more nearly straight, (*ingens*,) barred and more or less interrupted, arched in the middle posteriorly, in three distinct groups, (*punctatum venenosum*, Bart.,) tongue ovate, moderately free at its edges, slightly so in front, attached posteriorly; internal nares small in some species, larger in others; no sphenoidal teeth; tail more or less compressed, slightly in *venenosum* and *fasciatum*, very much in *tigrinum*, *ingens*, *nebulosum* and *laterale*, most in *tigrinum* and *ingens*; fingers and toes free, more or less depressed; skin smooth.

1. AMBYSTOMA PUNCTATUM.

*Char.*—"Body and tail above bluish black, with a row of round or oval yellow spots on each side; under surface bluish black, tinged with purple."—Holbrook.

Length  $5\frac{1}{2}$  inches.

*Habitat.*—Massachusetts, Vermont, Ohio, Maryland, Virginia, South Carolina, (Abbeville.)

Specimens in Mus. Acad. N. S. presented by Dr. Wilson, Bonap. col., Dr. Holbrook, Dr. Bache.

*Syn.* 1731. Catesby. The Natural History of Carolina, Florida and Bahama Islands, tom. ii. tab. 10, fig. 2. Spotted Eft; *Stellio aquaticus*; *Minor Americanus*.

1767. Petiver. Gazophylacium Naturæ et Artis. Decas vii. et viii., tab. 79, fig. 14. Carolina Salamander, Cat. 535, upper view; Decas x. fig. 2, under view.

1766. Systema Naturæ, Linn., edit. 13; Reformata Holmiæ, 48, *L. punctata*.

1788. *Lacerta punctata*, Linn.; Edit. decima tertia, Gmelin, Lepsius, p. 1076, No. 45.

1788. *L. punctatum*, Lacepede. Hist. Nat. des Quad. ovipares et serpens, 4to t. i. p. 491.

1789. Idem, Damberton. Encyclop. Met., p. 63, pl. 12, No. 1.
1801. Idem, Latreille. Hist. Nat. Rept. ar 18, p. 252. *Salamandra punctata*, Bonat. Erp. 63; Encyclop. Mit. t. xii. fig. 1; Merrem. Tentamem, 185.
1802. *Salamandra venenosa*, Daud. Hist. des Reptiles, t. viii. p. 229.
1802. Shaw, Gen. Zoology, tom. iii., p. 304, *Lacerta maculata*. Blackish water newt. *Salamandra venenosa*, Barton, Am. Phil. Trans., t. iv. t. i.
1803. *Salamandra subviolacea*, Barton, Am. Phil. Trans. t. vi. p. 112, pl. 4, fig. 16. (A good figure.)
1830. *Salamandra punctata*, ( $\beta$ . *Partitibus*) *nullis*, Wagler. Syst. Amphib., p. 208. Sec. 27.
1825. *Salamandra subviolacea*, Harlan, Med. and Phys. Research, p. 93.
1838. *Ambystoma subviolaceum*, Tschudi, Classif. du Batrach., p. 92, No. 3, (exclus. *Sal. fasciata*, and *Sal. variolata*, Gill., *Ambystoma fasciatum* et *Plethodon glutinosus*.
1842. Dekay, Natural History of New York, page 74, *Salamandra subviolacea*, violet colored Salamander, pl. 12, fig. 36, (exclus. syn. *Sal. symmetrica*, Dekay, Duméril and Bibron, and *Sal. maculata*, Green. Jour. Acad. N. S. vol. i. p. 2, 360, 350, (a bleached specimen of *Pseudotriton ruber*.)
1842. *Sal. venenosa*, Holbrook, N. Am. Herp. t. iii. p. 67, pl. 22, (2 ed.) 1st ed. 1837, t. iii. p. 105, pl. 24.
1850. *Ambystoma punctata*, Baird, Journ. Acad. Nat. Sci. vol. i. p. 283.
1850. *Ambystoma Carolinæ*,\* Gray, Cat. Br. Museum, p. 35.
1854. *Ambystoma argus*, Duméril and Bibron, t. ix. p. 103.

## 2. AMBYSTOMA TIGRINUM.—(The Tiger Ambystoma.)

*Char.*—Body elongated, bluish black, with numerous lemon colored spots irregularly disposed; tail longer than the body, greatly compressed, and spotted like the body; internal nares of moderate size; palatine teeth in a straight, or nearly straight transverse row. Length 6 in. and 7 lines.

*Habitat.*—Northern United States from New Jersey to Massachusetts, South Carolina, (Goose Creek;) a specimen in Museum of Charleston College. Specimens in Museum Academy Nat. Sci. Presented by Dr. Holbrook and Mr. Ashmead.

*Syn.* 1826, 1827. *Salamandra tigrina*, Harlan, Journal Academy Nat. Sci., vol. v. p. 328.

1825. *Salamandra tigrina*, Green, Jour. Acad. N. S., vol. v. p. 116. (A very good description.)

\* In the tenth of Linnæus, 1758, mention is made of *Lacerta punctata* from Asia. Gray refers to *Lacerta Carolinæ*, Linn., tenth edit., but we cannot find it.

1835. *Salamandra tigrina*, Harlan, Med. and Phys. Research., p. 93.  
 1842. *Triton tigrinus*, Holbrook, N. Am. Herp. p. 79, pl. 26.  
 1842. *Triton tigrinus*, Dekay, Natural History of New York, p. 83, pl. 15, fig. 32.  
 (A good figure.)  
 1850. *Ambystoma tigrina*, Baird, Jour. Acad. N. S. vol. i. p. 284.  
 1850. *Ambystoma tigrinum*, Gray, Catalogue Amphib. Br. Mus. Batrach. gradientia, p. 35, No. 2.

## 3. AMBYSTOMA PORPHYRITICUM.

*Char.*—General form more slender than that of the Ambystomata; head small, convex above, rounded in front, eyes latero-superior, prominent; tongue ovoid, firmly attached in front and posteriorly, more free at the sides; internal openings of the nares moderately large; teeth in a transverse uninterrupted row, arched in front, concave posteriorly; no longitudinal rows of teeth; skin perfectly smooth, of a uniform brownish color above, lighter below; fingers and toes free, rather slender, depressed, fourth toe longer than the third; tail much compressed, shorter than head, neck and body. Length 3 inches and 10 lines.

*Habitat.*—Wabash and Western Pennsylvania according to Prof. Holbrook. Habits aquatic.

One specimen presented by Dr. McMurtrie, another from Columbus, Ohio, by Mr. Lesceureaux.

*Syn.* *Salmandra porphyritica*, Green, Maclurian Lyceum.

*Salamandra porphyritica*, Harlan, Medical and Physical Researches, p. 98.

*Triton porphyriticus*, Holbrook, vol. v. p. 80.

## 4. AMBYSTOMA OPACUM.—(Blotched Salamander.)

*Char.*—Body and tail above palish ash color, with broad transverse bluish black blotches on the back and bars upon the tail; throat and abdomen indigo blue, tinged with purple; tail length of body, moderately compressed. Length 3 inches 4 lines.

*Habitat.*—Massachusetts, New Jersey, Ohio, South Carolina, Georgia.

Specimens in Mus. Acad. Nat. Sci., presented by Dr. Wilson, Dr. Bache, Mr. Ashmead, Dr. Leidy.

*Syn.* 1826. *Salamandra Gravenhorstii*, Leuckart, Fitzinger, new class, Rept., Wien, 4to., p. 66.

1818. *Salamandra fasciata*, Green, Tailed Batrachians, Jour. Acad. Nat. Sci., vol. i., part 2d, p. 350.

1825. *Salamandra fasciata*, Harlan, Journ. Acad. Nat. Sci., vol. v. p. 329.

1829. *Salamandra opaca*, Gravenhorst, Del. Mus. Vratislav, pl. x. p. 75.

1830. *Salamandra fasciata*, Wagler, Amphib., p. 208.



1835. *Salamandra fasciata*, Harlan, Medical and Physical Researches, p. 94.  
1842. *Salamandra fasciata*, Holbrook, North American Herpetology, vol. v. p. 71, pl. 23.  
1842. *Salamandra fasciata*, Dekay, Natural History of New York, p. 17, pl. 17, fig. 40.  
1850. *Ambystoma opaca*, Baird, Journ. Acad. Nat. Sci., vol. i. p. 283.

5. AMBYSTOMA TALPOIDEUM.

*Char.*—"Head very large, body short, thick, clumsy; tail short, thick, compressed, color above dusky, almost black; beneath dusky with a tinge of purple."—Holbrook. Length 3 inches 1 line.

*Habitat.*—Sea Island, on borders of South Carolina.

6. AMBYSTOMA LATERALE.

*Char.*—Jet black above, and below with numerous thickly agglomerated, white spots about the size of pins' heads upon the cheeks, sides of neck, body, tail and upon extremities; fingers and toes slender; teeth as in *fasciatum*. Length 3 inches 1 line.

*Habitat.*—Borders of Lake Superior.

7. AMBYSTOMA NEBULOSUM, *nob.*

*Char.*—Color brownish olive, (in spirits,) with numerous yellow spots, small upon the head, larger upon the body, largest upon the tail, where they are more or less confluent; under parts yellow; teeth in the form of an obtuse triangle; the apex forward, a little beyond a line drawn across the anterior margin of the internal nares, the posterior extremities passing behind them; internal nares remarkably large; fingers and toes very much depressed; first and fourth fingers of nearly equal length, second finger a little shorter than the third, fourth and fifth toes of equal length. Length 5 inches 7 lines. (Fr.)

*Habitat.*—San Francisco, Mountain, New Mexico, abundant.

One specimen in Museum of Academy.

*Syn.* *Ambystoma nebulosum*, Sitgreaves' Report of Exploration of Zuni river.

*Gen. Remarks.*—Spots much more abundant than in *tigrinum*, and less regularly shaped; toes of *tigrinum* less depressed; palatine teeth in latter in a straight line.

8. AMBYSTOMA MAVORTIUM.

*Char.*—Dull black or brown, (in spirits,) yellow blotched above and below; back with about nine, tail with thirteen transverse yellowish bands; body thick; feet short, broad; tail much compressed, longer than body and head; skull broader than long. Length 8 inches.

*Syn.*—*Ambystoma mavortia*, Baird, Journal Academy Natural Sciences of Philadelphia, vol. i. p. 292. 1850.

*Habitat.*—New Mexico.

#### 9. AMBYSTOMA INGENS.

*Char.*—Head large, depressed, neck slightly contracted, color light brown or olive, with numerous dark colored blotches (in spirits); internal nares small, transverse palatine teeth, presenting a very obtuse angle in front, much less acute than in *nebulosum*; tail very greatly compressed, longer than head, neck and body; extremities very stout; fingers and toes much depressed; body robust; (the largest by far of our *Ambystomata*.) Length 10 to 12 inches and more.

*Habitat.*—New Orleans.

One specimen in Mus. Acad. from Green's collection, (Dr. Bache.)

*Syn.* *Xiphonura Jeffersoniana*, Tschudi.

*Gen. Remarks.*—This species and *tigrinum* would come under the genus *Xiphonura*, Tschudi, but several other of our *Ambystomata* have compressed tails, viz.: *laterale*, *talpoideum*, *nebulosum*; and as the substitution of *Xiphonura* for *Ambystoma* leads to confusion, we shall not adopt it, but prefer grouping them into *Ambystomata* with tails much compressed, of which *ingens* may be considered the type, and those with tails more or less rounded as *venenosum* and *fasciatum*; *Xiphonura Jeffersoniana*, Tschudi, is very probably *Ambystoma ingens*, but *Salamandra Jeffersoniana*, Green, is *Plethodon glutinosus*.

#### 10. AMBYSTOMA LURIDUM.

*Char.*—Teeth more acutely angular than in *tigrinum*; internal nares much larger; tongue quite broad; color dark brown with yellow spots irregularly disposed, the yellow predominating upon the body, throat and chin, being the ground color, the chin and under jaw almost exclusively yellow; tail much flattened, shorter and more robust than in *Mavortium*; body robust; extremities very stout; fingers and toes moderately depressed; fourth finger longer than first, third and fourth toes of nearly equal length; seventeen dorsal vertebræ; pelvis attached to seventeenth; twenty-four caudal; no bony ridges upon posterior parts of cranium as in *Pseudotriton ruber*. Length 7 inches.

*Habitat.*—Michigan, Wisconsin, Illinois and Kansas,

3 specimens in Mus. Acad., presented by Prof. Baird, Mr. Lewis Germain and Dr. Hammond, U. S. A.

*Gen. Remarks.*—There are four yellow spotted species, which are nearly allied, but differ in the arrangement of the teeth, which will at once characterize each, viz.: *tigrinum* in a straight transverse row; *luridum* obtusely angular; *episcopus* much less obtusely angular, and finally *nebulosum* where the angle is acute.

11. AMBYSTOMA EPISCOPUS, *Baird*.

*Char.*—Head rather large, longer than broad, snout obtusely angular, eyes prominent; tongue strongly adherent posteriorly, more free in front at the sides; internal nares rather large; transverse teeth passing across the palate, a short distance behind the internal nares, forming an angle more obtuse than in *nebulosum*, and distinctly divided into three portions, the two posterior being in a line with the anterior margin of the internal nares; these are much smaller than in *nebulosum*; body short, tail much compressed, shorter than head, neck and body; extremities slender, toes much depressed.

*Color.*—Under parts yellow, above brownish yellow, with numerous dark colored spots and blotches, and a few yellow spots more distinct; the spots are more numerous, smaller and more distinct upon the head; a darkish band along the sides; dark colored blotches more distinct upon sides of tail. Length 3 inches 8 lines.

*Habitat.*—Kemper County, Mississippi.

## 12. AMBYSTOMA PROSERPINE.

*Char.*—Head rather large; snout obtuse, eyes prominent; internal nares small; teeth ———; tongue firmly attached posteriorly, more free in front and upon the sides; body short and rather stout tout; tail compressed; extremities well developed; fingers and toes much flattened; color yellow beneath; ground color above yellow, with large brownish blotches upon the head, body and sides of tail; extremities yellow. Length 3 inches 11 lines.

*Habitat.*—

13. AMBYSTOMA MACRODACTYLUM, *Baird*.

*Char.*—Quite small, the smallest perhaps of our known *Ambystomata*, resembling much *Plethodon erythronotus* in its general appearance; head small; internal nares small; teeth in a transverse interrupted series, passing entirely across the palate behind the internal nares, divided into four distinct patches; the two middle ones forming an obtuse angle, the apex not extending as far anteriorly as the anterior border of the internal nares; tongue adherent posteriorly, more free in front and at the sides; fingers and toes quite slender; first and fourth finger about equal length; third finger a little longer than second, third and fourth toes of equal length; tail shorter than head, neck and body, and moderately compressed; color brownish black above with a reddish stripe along the middle of the back and tail, resembling *erythronotus*; numerous very minute whitish points along the sides; brownish black beneath. Length 2 inches 2½ lines.

*Habitat.*—Astoria, Columbia River.

2 specimens in Mus. Acad. Nat. Sci., presented by Dr. Townsend.

14. *AMBYSTOMA CALIFORNIENSE*, Gray.

Above blackish, with numerous yellow subround spots a line or more in diameter, more or less thickly agglomerated; under parts yellowish; internal nares small; palatine teeth forming an obtuse triangle, commencing behind the nares, on a line with their external margin. Length 2 inches 4 lines to  $4\frac{1}{2}$  inches, tail  $1\frac{1}{2}$  inches.

*Habitat*.—California and Rocky Mountains.

One specimen from Rocky Mountains in Mus. Acad. Nat. Sci., presented by Dr. Hammond, U. S. A.

A specimen in Museum of College of South Carolina, presented by Prof. Forbes.

*Syn*.—*Ambystoma Californiense*, Gray, Proceedings Zoological Society, London, 1853, p. 11.

15. *AMBYSTOMA FUSCUM*, nob.

*Sp. Char*.—Head large, convex; eyes large, prominent; snout rounded; nostrils small, two and a half lines apart; internal nares rather large; teeth nearly transverse, in four distinct patches, extending across the palate, behind the internal nares; fingers depressed, the first and fourth of nearly equal length, the fourth larger than the third; fourth toe the longest; toes slightly webbed at base; tail ensiform; of nearly same length as head, neck and body; color uniformly dark brown above, with extremely minute white points upon the body and tail, more sparse upon the former; chin yellow clouded with brown beneath.

*Habitat*.—Indiana, near Hanover College.

*Dimensions*.—Length of head 8 lines; of greatest breadth 6; length of body 1 inch 11 lines; of tail 2 inches 7 lines; of arm 2 lines; of forearm 3; of hand to extremity of longest finger  $3\frac{1}{2}$  lines; of thigh 3 lines; of leg  $3\frac{1}{2}$ ; of foot to extremity of longest toe 5 lines. Total length 5 inches 2 lines. One specimen presented by Prof. King, of Hanover College.

16. *AMBYSTOMA MACULATUM*, nob.

*Sp. Char*.—Head large; body stout; tail ensiform; fingers and toes depressed; posterior nares of moderate size; teeth arched in four patches, the two middle convex anteriorly, nearly in contact; color brownish above; tail maculated with black, under parts yellow. Total length  $7\frac{1}{2}$  inches; tail  $3\frac{3}{4}$  inches.

*Habitat*.—New Mexico.

One specimen in Mus. Acad., presented by Dr. McClellan.

ONYCHODACTYLUS,\* *Tschudi*.

*Char.*—Tongue rounded, entirely free only at the edges; palate furnished with teeth, forming a continued undulating series resembling the letter M, with rounded angles; skin smooth, porous, but not tuberculous; a parotid slightly projecting on each side, separated, as it were, into two parts by a deep line proceeding from the commissure of the mouth; tail rounded, very long, but compressed in its terminal fourth; fingers free, terminated usually by a black spot, resembling exactly above the shape of a nail."—D. & B.

ONYCHODACTYLUS SCHLEGELII, *Tsch.*

Color deep brownish gray, less intense beneath; sometimes marbled with yellow, or totally gray in the adult; a large brownish or reddish-yellow stripe extends along the back, irregularly variegated on its edges by brown spots; continues upon the tail, but on the head, divides and breaks into fine marblings composed of the two principal tints.

*Syn. Salamandra unguiculata*, Schlegel, Faun. Jap., p. 123, pl. 5.

*Habitat.*—Japan.

EUPROCTUS, *Gené.*—MEGAPTERNA, *Save.*

*Char.*—Tongue rounded, free behind and upon the sides, adherent in front only; head quite large with a smooth rounded snout; no parotids; palatine teeth in two longitudinal rows, parallel in the first half of their course, diverging posteriorly; skin rough and covered with small warts; tail pointed, rounded at base, compressed in four-fifths of the length, which is greater than that of the body; fingers free, elongated, rounded; anal region in adult prolonged,† coniform; a bony arch above the orbit, formed by the union of the processes proceeding from the posterior, frontal and tympanic bones.

EUPROCTUS RUSCONI.

*Char.*—Body warty, smooth in the young, of a brownish olive, with black marks above; of a yellowish grey or ferruginous below, with points or irregular blotches of a blackish blue color; upper parts sprinkled with numerous white elevated blotches. Length 2 inches 9 lines.

*Habitat.*—Pyrenees, Italy, Spain, Sardinia and Corsica.

2 specimens in Mus. Acad., Bonap. collection, presented by Dr. Wilson, and two by the Garden of Plants.

\* Οὐζὶ nail; δακτύλος finger.

† Not a constant character.

## EUPROCTUS POIRETI.

*Char.*—Body brown above, with blackish spots; rust color beneath; tail longer than the body with a yellow longitudinal line above running its whole length. Total length 5 inches; tail 2 inches 5 lines.

*Habitat.*—Algiers. One specimen in Mus. Acad., presented by the Garden of Plants.

TRITOMEGAS, *Dum. and Bib.*

*Char.*—"Body very large, warty, depressed, bordered with a thick festooned membranous fold; head flat, oval, larger than the trunk; tongue slightly distinct, adherent, forming the floor of the mouth; palatine teeth numerous, serrated, disposed in a continuous and parallel arcade, behind those of the jaw; nostrils near together upon the anterior edge of the snout; eyes small, separated, with lids very short or absent; tail short, compressed, with a crest."—Dum. and Bib.

## TRITOMEGAS SIEBOLDII.

*Habitat.*—Japan, high mountains of the Island of Nippon, between 34° and 36° N. latitude, 4000 to 5000 feet above the level of the sea. Habits aquatic; feeds on fishes and frogs, swallows ordinarily twenty or more small fishes at once, then remains eight or ten days without food.—D. and B. Length 3 feet.

*Gen. Remarks.*—The Japanese and Chinese physicians, according to Schlegel, use the flesh of this animal made into soup, as a preservative against contagious affections, in phthisis, and other diseases of the chest, and to promote digestion. Fauna Japon., p. 135.

TARICHA, *Gray.*

*Char.*—Head flat, longer than broad; snout angular; eyes very prominent; skin above densely granulated; tongue of moderate size, rather small, oval, papillose, attached in front and behind, more free at edges; maxillary teeth small; internal nares of moderate size; no palatine teeth; sphenoidal teeth small, arranged in two very slender rows, commencing in a line with the internal nares, and about equidistant from them; not in contact, diverging as they extend posteriorly, leaving a wide interspace behind; body rather stout, extremities well developed; fingers and toes short and depressed, free; first toe a knob, shorter than fifth, third toe a little longer than fourth; tail rounded at base; compressed in two-thirds of its extent; longer than head, neck and body; no parotids.

## TARICHA TOROSUS.

*Char.*—Dark brown, covered with numerous granulations or tubercles, more sparsely

upon the throat and under part of extremities ; granulations very fine upon abdomen ; under parts yellowish. Length 6 inches.

Specimens in Mus. Acad. Nat. Sci.

*Habitat*.—San Francisco.

TRITON, *Laurenti*. 1768. *Fitzinger*, 1843.

*Char*.—Tongue fleshy, papillose, round or oval, free only upon the edges; palatine teeth forming two longitudinal series, approximating or almost parallel, or closely in contact in front, diverging posteriorly, leaving a triangular interspace; no transverse palatine teeth: body smooth or granular; head smaller than the middle portion of the body, which is slightly flattened beneath; tail constantly compressed when the animal inhabits fresh water, with vertical cutaneous margins, at least in the males, especially at the epoch of fecundation.

*Habitat*.—Europe, Asia, Africa.

TRITON ALPESTRIS.

*Char*.—Body of an ash color, more or less deep above; a series of small subcircular black spots along the sides and margin of jaws; extremities spotted with black; abdomen and throat orange colored, of a cherry red color during life, without spots; tail about as long as body, compressed, upper and lower edges acute yellowish, marked with brown spots (a variety of *cristatus*, according to Schlegel, Faun. Japon. Rep., p. 116.) Length 2 inches 7 lines.

*Habitat*.—Hungary, Austria, Italy.

23 specimens in Mus. Acad. Nat. Sci., (Bonap. col.) presented by Dr. Wilson, one specimen presented by Garden of Plants.

TRITON CRISTATUS, *Laurenti*.

*Char*.—"Skin granulated, of a brownish green, often very deep upon the back and sides; with large black spots, and small white salient spots, especially upon the sides; under part of the body of an orange yellow, with black irregular spots; inferior portion of the tail most often of a golden yellow, without spots; throat brown, with some yellow marks, without large black spots, but small brown lines, and minutely punctated with white. The male carries upon the back, especially at the period of fecundation, a large brown membranous denticulated crest, which commences upon the anterior part of the body, and is continued along the spine as far as the pelvis, where it disappears; the tail, which is much compressed and large in the middle, presents also, above and even beneath, a crest, the superior one of which is also slightly denticulated or festooned; the crest of the female is not so much developed,



and the underpart of the tail presents constantly a line or vitta of a yellow color, more or less marked."—Dum. et Bib.

Duméril and Bibron, who have had frequent opportunities of observing these animals alive, describe three varieties—1. Very large, of the size of *Salamandra maculosa*; blackish above, yellow spots under the jaw in the male, and under part of tail in the female yellow, without spots. Var. 2. A little more than half the size of the first. Brownish above, or greyish in the males, yellow color of abdomen less deep; these varieties perhaps the affect of age. Var. 3. *Triton carnifex*; females of small size; no dorsal crest, replaced for the most part by a yellow line prolonged upon the tail. What distinguishes most, however, this variety is the pale yellow or whitish color of the abdomen, with large black rounded spots; but rarely spotted in the middle region. Length  $4\frac{1}{2}$  inches long, (Fr.)

*Habitat*.—Common in Europe, (abundant in N. of France,) found in the coldest regions, (N. Africa, Schlegel.)

77 specimens in Mus. Acad. Nat. Sci., Bonap. col., presented by Dr. Wilson; one specimen without name or locality.

#### TRITON MARMORATUS, Latreille.

*Char*.—Body rough or warty, sometimes of a light green, or more or less deep with marbled black spots, more or less confluent, or with spots of a brownish red upon a ground of deeper brown; for the most part a yellow line, or band, or of a beautiful carmine red, extending the whole length of the back from the nucha as far as the middle portion of the tail; the under part of the body varies, sometimes it is black or of a venous red, with white points, more or less sparse, and grouped together; sometimes it is very pale."—Dum. et Bib.

Duméril and Bibron, who have especially observed this Triton, living and of different ages, describe three varieties: 1. A line of a beautiful red, almost carmine, extends all along the middle line of the back and tail, changing sometimes into orange yellow; throat and abdomen reddish venous brown, with small white points; under part of the tail of the same red color. 2. Brown above, with a very pale yellow dorsal line; no spots upon the under part of the abdomen; under part of the tail red or orange yellow. 3. One fourth the size of the first, perhaps the young; light grey above, with a dorsal yellow line; rounded spots and black markings upon the sides; sides of a uniform brown color; under part of the body reddish, without any spot, or very distinct white spots. "Most authors," observe Duméril and Bibron, "regard *Triton marmoratus* as a variety of *Triton cristatus*."

*Habitat*.—Whole of France, especially the southern portion.

*Remarks*.—We have in the Bonaparte collection a single specimen marked *Triton*

*marmoratus*, which corresponds precisely with the figure of the same in the Fauna Italica, of which it is, most probably, the original, which differs from the above description. It is extremely rugose, of a uniform dark ash color; the markings upon the sides very indistinct; an orange line under the tail; abdomen light orange, with numerous irregularly shaped black spots of different sizes; more or less confluent. It resembles very much some of the specimens of *Triton cristatus*, but there are no round black spots upon the sides; and the dorsal line is absent. According to Kauf, *Triton marmoratus* is found 6 inches in length, and exists also in the south of Spain. According to A. Dugis, the tail is round in the winter, flattened at the nuptial season. According to Duméril and Bibron, *Triton nycthymerus* is *Triton carnifex*, the young of *Triton marmoratus*, but the specimen in the collection of the Academy, marked *Triton nycthymerus*, is very different from *carnifex* and *marmoratus*. The tongue is *small and free* behind, as in *Pleurodeles*. *Triton nycthymerus* is found in the Tyrol and Picardy. Schlegel remarks that *Triton marmoratus* is sometimes perfectly smooth, without the slightest trace of tubercles. It is found, also, according to him at Tunis.

Two fine specimens in Mus. Acad. N. S., presented by the Garden of Plants, corresponding in every respect with the description of Duméril and Bibron.

#### TRITON PALMATUS.

*Char.*—"Skin slightly granular, of a yellowish brown above, with two salient dorsal lines, parallel to the salient line of the spine; the under part of the body of a beautiful deep orange color, more yellow towards the sides; the posterior extremities of the male, in the commencement of spring, of a darkish brown, with the five toes almost entirely palmated; the females of a lighter color, with the tail almost round, especially after having been a long time out of the water."—Dum. et Bib.

Length 2 in. and 8 lines.

*Habitat.*—France, England Germany. The most common Triton in the neighborhood of Paris; common also in the neighborhood of Montpellier.—Dugis.\* Two specimens presented by the Garden of Plants, 55 specimens in Mus. Acad. Nat. Sci., (eleven of them marked Vienna, Bonap. Collection,) presented by Dr. Wilson.

#### TRITON PUNCTATUS, Latreille.

*Char.*—"Skin smooth, of an ash colored greenish brown, or yellowish above, with black, rounded, distinct spots disposed very regularly and by lines; five black lines, more or less distinct, uniting upon the anterior part of the head, of which one appears to traverse the eye, advancing upon the sides of the neck; the under part of the body

\* Found throughout France. The female lays its eggs one by one, in the leaf of an aquatic plant, which it folds in two with its hind feet. In captivity and without plants it lets them roll freely into the water.—Dugis.

of a more or less deep yellow, and even orange, with large rounded black spots, disposed in a somewhat regular manner, in two or three lines on each side."—Dum. et Bib.

Duméril & Bibron describe three varieties of the males and as many of the females of this species: 1, with a very distinct crest, with the toes sometimes palmated or semi-palmated, then becoming simple or not lobed; *tæniatus*, Wolf, Gravenhorst, Schneider; *punctatus*, Latreille, Merrem; *palmipes*, Daudin in Latreille. 2, crest scarcely distinct, with the toes simple; *punctatus*, Daudin. 3, males in which the crest of the back and tail are more apparent, as well as the membranes bordering the toes. Of the females, the first variety are brown above, with two longitudinal lines of a deeper color upon the back, and spotted with black beneath; beneath small black spots in the intervals between the large rounded spots, likewise upon the borders of the lower jaw; tail yellow beneath. Length 2 inches 6 lines.

*Habitat*.—Very common in the neighborhood of Paris, and other parts of the north of France; aquatic, oviparous.

62 specimens in Mus. Acad., Bonap. collection, presented by Dr. Wilson, labelled *Triton lobatus*; two or three of them labelled *Nilsson* appear to be *cristatus*.

According to Dugis the *exiguus* is a young *palmatus*, and *abdominalis*, Latreille, the young of the female of *punctatus*.

#### TRITON VITTATUS, Gray.

*Sp. Char*.—"Body smooth, of a greyish white color, with large black points or spots arranged in longitudinal lines; a large yellow or reddish band, bordered with black, above and below, extending upon the flanks, from the axillæ and two-thirds or more of the side of the tail; under part of the belly yellow or red, marked with black points more or less abundant."—D. & B. t. ix. p. 144.

*Habitat*.—France and England.

One specimen in Mus. Acad. Nat. Sci., presented by the Garden of Plants, another larger, with the lateral stripe on both sides broad and well developed, by Dr. Bache, forming part of the Green collection. Length of largest specimen 3 inches 10 lines; of tail 1 inch 9 lines.

*Gen. Remarks*.—According to Duméril and Bibron this is a doubtful species, being intermediate in its characters between *T. alpestris* and *T. punctatus*. It is the *Lisso-triton palmipes* of Bell, (British Reptiles,) the *Molge* and *Ommatotriton vittatus* of Gray.

#### TRITON PYRENÆUS, Dum. & Bib.

*Char*.—Body warty or very rough, with salient points, brown upon the head and sides, with a large yellow colored or saffron dorsal ray, continued almost from the

nucha to the end of the tail, but denticulated irregularly with brown upon the edges, and marked with isolated salient black points, few in number, upon the dorsal region. The under part of the body, from between the angles of the jaw, the neck, the belly and under part of tail, as well as the under part of the members, of a yellow or saffron colored tint, with regularly defined margins.

*Habitat*.—Pyrenees.

TRITON SUBCRISTATUS, *Schlegel*.

*Char*.—Body warty, head large, flat and obtuse; lateral tubercles at the commencement of the neck; upper part of the body of a more or less deep brown, with a small dorsal crest, as it were, effaced; under part of the body red, with irregular very deep black spots; the under part of the extremities of the same red color, with some small spots or black points. (Gen. *Cynops*, Tschudi.)—D. & B.

*Habitat*.—Japan.

*Gen. Remarks*.—Duméril and Bibron say that Tschudi has separated this animal from the *Tritons*, giving it a name indicative of no character, supposing that the tongue was adherent throughout, but in the account of this genus in the German of Tschudi, the only mention I find made of the tongue is that it is “sehr klein,” very small. The generic characters are based upon the differences in the osteology of the skull, which, he says, is quite different from that of *Triton*. Not having the specimens, we cannot determine this point. Gray mentions the tongue as adherent, scarcely free on the edges.—Cat. Br. Mus., p. 24.

Duméril and Bibron consider it as allied to *Euproctus*, Bonaparte and Gené. Duméril and Bibron, besides the above, describe five species from the Pyrenees, collected by Bibron, viz. : *rugosus*, *cinereus*, *repandus*, *punctulatus* and *Bibroni*, which according to A. Dugis and M. Gervais, as stated by them, are varieties of *Euproctus rusconi*. For description of them, see their work, p. 150—154, t. ix.

DIEMYCTYLUS, *Raf*.

*Char*.—Tongue small, ovoid, adherent in front and superiorly, somewhat less at the sides; no transverse palatine teeth; two longitudinal series of palatine teeth in contact in front, diverging posteriorly; posterior nares quite large; two longitudinal ridges upon the cranium in contact in front, diverging posteriorly; a bony bridge above the orbit, as in *Cynops* and *Euproctus*; spinous processes of vertebræ quadrangular, compressed, laterally well developed; three foramina on the sides of the head, not communicating with the mouth; first and fifth toes rudimentary.

*Gen. Remarks*.—*Diemyctylus*, as observed by Prof. Baird, appears to be closely related to *Cynops*, Tschudi, *Molge pyrrhogastra*, Boié. Isis, 1826, p. 215, *Triton subcris-*

*tatus*, Dum. & Bib., vol ix. p. 140. In *Cynops* there are altogether 40 vertebræ and 16 dorsal,\* the pelvis attached to the 15th and 16th. The ribs are larger and stouter than in the European *Salamanders*; the spinous processes very strong and broad, arranged like a comb; vertebræ of the tail much compressed, with strong processes below. See Tschudi, *Batrachier*, p. 60.

DIEMYCTYLUS VIRIDESCENS, Raf.

*Char.*—Olive colored above, with ordinarily from three to eight small circular spots, bordered with black, upon each side of the dorsal line; abdomen olive, dotted with black; tail more or less compressed, longer than head, neck and body; no parotids. Length 3 inches 9 lines.

*Habitat.*—Florida, Alabama, Carolina, Virginia, Maine, Pennsylvania, (Carlisle, Cresson,) Georgia, New York, (Lake Champlain,) Massachusetts, Ohio, (Cleveland.)

28 specimens in Mus. Acad. Nat. Sci., presented by Dr. Wilson, Dr. Bache, Mr. Ashmead, Dr. Blanding and Dr. Harlan.

DIEMYCTYLUS MINIATUS, Raf.

*Sp. Char.*—Skin granulated, of an orange color, deeper above; on each side of the back a row of small, subrotund, crimson spots, bordered with black; tail compressed, of same length as body. Total length 2 inches 8 lines.

*Syn.* *Salamadra symmetricus*, Holbrook, North American Herpetology, vol. v. p. 57, Pl. xvii.

*Habitat.*—Pennsylvania and Delaware.

*Gen. Remarks.*—This animal, as Dr. Holbrook remarks, appears to be distinct from *viridescens* and *Triton dorsalis*, Holbrook, the latter living in the water, the other being an inhabitant of the land.

*Triton dorsalis*,† (*Notophthalmus miniatus*, Raf.) and *Diemyctylus viridescens*, (*T. symmetrica*,) appear to be the same, the difference in their form and color being attributable, in all probability, to differences of habitat and sexual peculiarities. We have some specimens without any spots, others with only one, and others with from three to eight on each side; the spots in all the specimens are small, round, and bordered with a margin of black, and the body and abdomen more or less minutely dotted with black. In some specimens, however, the upper surface is orange, without spots. There may be described the following varieties—1st. Orange-colored above, lighter upon the head, with three or four small, round spots, bordered with black, on each side; underparts orange, sparsely dotted with black; a few black

\* 14 according to Schlegel and 16 in *Triton cristatus*.

† From the longitudinal stripe along the middle line of the back.

dots upon the tail, (*Triton symmetricus*, Holb.) It is to be observed, however, that these spots are not always symmetrically disposed, but in the specimen before me, the first on the right side is about two lines in advance of the same on the left, and the number of spots is not always the same on each side; sometimes two spots on the right side, four on the left, much smaller than the others and granulated.

2d. var. Same distinction of spots, skin almost smooth, abdomen more thickly dotted with black; under parts orange, (*millepunctatus*, Storer, *punctatissimus*, Wood,) or with a row of small circular spots, five in number, on each side, not very regularly disposed; probably an advanced age of No. 1.

4th. Tail more or less crested above and below; four or five or eight circular spots bordered with black on each side, the two first on each side of the occiput, as in some of the other varieties; body above and below very minutely dotted with black; sides of tail black spotted; spots large upon the root, nearly as large as those of *Triton cristatus*. In some of them the circular spots are quite indistinct, or united to each other forming longitudinal bands; in others there are no circular spots whatever, the back being covered with brownish irregular lines; a longitudinal band of black running from the throat along the side of the head, neck and abdomen, and continued along the tail; two black longitudinal lines on each side of the salient dorsal line, and a longitudinal line on each side; the sides of the body, as well as the tail, are spotted with black, the spots much larger upon the tail; under parts yellow, very minutely punctated with black, (*millepunctatus*, Storer.) We are informed by Prof. Leidy, the vermillion colored specimens were found invariably upon land, and the olive colored ones always in the water, or in marshy places, so that it would appear that these, as stated by Prof. Holbrook, are really distinct species. It is to be regretted, however, that we do not know more of the habits and mode of life of each.

We have received to-day, through Dr. Wilson, Prof. Leidy and Mr. Conrad, who have been spending several weeks at Cresson, at the top of the Alleghanies, about 225 miles west of Philadelphia, at a height of 2300 feet, a considerable number of specimens of *Diemyctylus miniatus*, Raf., (*S. symmetrica*, Holb.,) and *Diemyctylus viridescens*, Raf., (*Triton dorsalis*, Holb.) The former present nothing remarkable, and have been sufficiently well described. The latter present the following appearances: These 13 specimens of *Diemyctylus viridescens* resemble each other very closely. They are of an olive color above, deeper in some specimens than in others, with a vertical yellow line extending from the occiput some distance upon the tail; on each side is a row of vermillion spots bordered with black, varying in number, but usually five or six on each side; sometimes a few smaller ones may be observed irregularly disposed. The yellow vertical line is often bordered with black, sometimes in the form of spots, at others assuming the form of a yellow band upon the

tail, bordered with black; sometimes two rows of spots on one side, the left, with a single upper row on the right, and one below, very symmetrically disposed, in the small specimens.

ELLIPSOGLOSSA, *Dum. et Bib.*

PSEUDOSALAMANDRA and HYNوبيUS, *Tschudi.*

*Char.*—Tongue oblong, entire, a little more narrow and rounded in front, larger towards the front, oval in form, plicated longitudinally, free at the sides only; palate armed with small teeth, disposed in two longitudinal rows, in contact posteriorly, separated in front, in the form of a V, of which the free extremities are turned outward; two flattened parotids upon the sides of the head and neck; flanks rounded; four fingers in front; five toes, all free, short and without nails or corneous extremities; tail short, very much compressed, especially at its extremity.—*Dum. et Bib.*

ELLIPSOGLOSSA NÆVIA.

*Char.*—Body much elongated; trunk and neck slender, rounded; tail very much compressed, one-fifth shorter than the body; color bluish slate grey, with small spots of a lighter color, and marked upon the sides; skin smooth above and below. Length —.

*Habitat.*—Japan.

ELLIPSOGLOSSA NEBULOSA.

*Char.*—"Trunk short and thick; color yellowish brown, more or less deep, with very fine marblings; tail much compressed, with generally a yellowish line above and below."—*D. & B.* Length —.

Habits aquatic; swims with great facility, so much so as to be taken for a fish.—*D. & B.*

*Habitat.*—Japan.

HEMIDACTYLIUM,\* *Tschudi.*—DESMODACTYLUS, *Dum. et Bib.*

*Char.*—Four fingers and four toes; tongue oval, attached in front and along the middle, more free posteriorly; two rows of palatine teeth, beginning each on a line with the internal border of the posterior opening of the nares, extending behind it, and converging toward each other, and two rows of sphenoidal teeth, separated from the first by an interspace without teeth, and from each other by a wide interspace, nearly parallel; fingers and toes united at base by a membrane, that of the fingers and toes short and stout, salamandrine in form, the outer and inner ones very small;

\* ημυς one-half; δακτυλος finger



body short, round, head small, truncate, convex superiorly; tail round at base, compressed towards the tip, longer than head, neck and body; costal furrows deep.

HEMIDACTYLIUM SCUTATUM.

*Char.*—Skin of the back divided as it were into compartments, resembling plates or scuta, (costal folds); deep brown above, pale yellow behind, with irregular black spots upon the throat, sides and tail. Length —.

*Syn.*—*Salamandra melanosticta*, Gibbes; *Desmodactylus melanostictus*, Dum. et Bib., Erpet. Gen., t. ix. p. 119.

*Habitat.*—Abbeville, South Carolina. (Prof. L. R. Gibbes.)

One specimen in Mus. Acad., presented by Dr. Holbrook, from Chicago, where it appears to be common. Habits terrestrial. The specimens found by Dr. Gibbes were under decayed wood, and the form of the tail in the specimens before us would indicate a habitat in land rather than water, being more or less rounded in the greater part of its extent.

ART. XXII.—On *Trigonophrys rugiceps*.

By EDW. HALLOWELL, M. D.

Gen. TRIGONOPHRYS, *nob.*

*Char.*—Head very large, depressed; upper eyelid triangular; tongue large, sub-circular, notched in front and posteriorly, more deeply behind, attached anteriorly, free laterally, and in its posterior half; upper maxillary teeth large, conical, recurved, sharp pointed; two groups of vomerine teeth on a line with the anterior margin of the posterior nares, nearer to these than to each other; posterior nares large, sub-circular; eustachian foramina of moderate size; no vocal vesicles either internal or external; tympanum indistinct; four fingers completely free; toes palmate at their base only; first cuneiform bone presenting a prominence externally, with a well defined projecting edge; transverse processes of the sacral vertebræ not dilated.

## TRIGONOPHRYS RUGICEPS.

Plate 36.

*Sp. Char.*—Vomerine teeth in two small patches at the inner edge of the internal nares; dental apophyses very distinct; toes pointed, palmate at the base only; fourth toe much longer than the others; head presenting numerous asperities upon its upper surface; body pustulated above and upon the sides; abdomen smooth; two glands, triangular in shape, upon the upper surface of each thigh, and two larger ones upon the breast; color olive or violet above with numerous large dark colored ovoid spots margined with white; the interspaces in the young and middle aged of a beautiful rose color; extremities olive colored above, with large and broad bands of black, margined with white, the interspaces more or less tinged with rosy red; abdomen white, black spotted.

*Description.*—The head is very large, broader than long, flattened or very slightly convex above, depressed, the inclination in front not very abrupt; the nostrils, which are two crescentic openings, are situated about midway between the margin of the upper jaw and the inferior border of the orbit, nearer to the former, four lines apart; eighty-two teeth may be counted in the upper jaw, the anterior and middle ones longer than the posterior, concave posteriorly; their convexity presenting forward, very much enveloped at the base; two movable bucklers beneath the skin, posterior

to the occiput, suboval in shape, their upper surface, as well as that of the head and its sides, rough, from the numerous asperities with which it is covered; body more or less covered with rounded tubercles above; thighs granulate posteriorly; two well marked glands, triangular in shape, upon the upper surface of each thigh near the groin; two others, much larger, are seen upon the breast, between the anterior extremities; abdomen, throat and under surface of extremities smooth; tubercles beneath the fingers and toes; those at base of thumbs and upon palms much larger; projection of the cuneiform bone much developed, with a well defined edge.

*Coloration.*—The ground color above is violet or olive; the body and sides presenting numerous large dark colored ovoid spots, with a very narrow margin of white; the interspaces between these spots, in the young and middle aged specimens, are of a beautiful rose color; extremities olive colored above, with large and broad bands of black, margined with white; the interspaces more or less tinged with rosy red; under parts white, mingled with yellow; chin and throat with numerous black spots; abdomen also black spotted, but much less thickly than the chin and throat, sometimes without spots.

*Dimensions of the largest specimen.*—Length of head 1 inch 4 lines; greatest breadth 2 inches  $3\frac{1}{2}$  lines; breadth of bucklers 1 inch  $7\frac{1}{2}$  lines; length of body 3 inches; breadth 3 inches 2 lines; length of anterior extremities  $2\frac{1}{4}$  inches; of arm 1 inch 2 lines; of forearm 1 inch; of palm and longest finger 11 lines; of thigh 1 inch 4 lines; of leg 1 inch 1 line; of sole and longest toe 2 inches; of posterior extremity 4 inches.

*Anatomy.*—The structure of the skull in this genus resembles that of *Ceratophrys*, but it is comparatively longer, and the teeth are much more highly developed. The orbitar foramina are widely apart in *Ceratophrys*. The skull in *Trigonophrys* is covered all over with well marked rugosities, the temporal fossæ are much larger in the latter; the skull itself is triangular in shape, depressed in front, hollowed between the orbits, consisting of a solid bony case, with traces of sutures only in front of the latter; the orbitar foramina are subcircular in shape, measuring  $4\frac{1}{2}$  lines transversely, and are three lines apart; the occipital foramina are large and oval; upwards of fifty recurved conical teeth may be counted in the upper jaw, the anterior much the larger; the openings of the internal nares are oblong and quite large; two small bunches of palatine teeth are situated at their inner extremities on a line with their anterior margin; the nostrils are small, three lines apart, about four lines from the anterior extremities of the cranium. There are eight vertebræ, exclusive of the atlas and sacrum; the spinal processes of the first are much more developed than those which follow; the transverse processes are seven in number, of these the second and the third are the longest, the former measuring five lines in length; the

transverse processes of the sacral vertebræ measure three lines in length and are thicker at their external extremity; the os coccygis is depressed, nine lines in length; the iliac bones and those of the extremities present nothing remarkable; the sternum does not differ materially from that of *Ceratophrys*. The difference in the structure of the skeleton in this animal and *Rana pipiens*, or common bull-frog, is very striking; indeed, it could hardly be greater in two genera belonging to the same family. The orbital foramina are more than double the size; the nasal openings very large; the scapula remarkable for their great breadth, and the ribs are of nearly equal length.

*Viscera*.—The skin is very loosely attached to the thin and semi-transparent fascia covering the muscles, its inner surface presenting numerous inosculating small vessels distributed over its surface; immediately beneath this fascia two muscles shew themselves on each side, broad at their base and fanlike, the anterior inserted into the upper surface of the humerus near its proximal extremity, the inferior into the symphysis pubis. On cutting into the peritoneum; the *liver* consists of three lobes occupying the right and a portion of the left side of the abdominal cavity, the right lobe trefoil in shape, the middle somewhat pyriform, and the left more or less quadrangular in shape, its anterior margin presenting a waved outline; the *gall bladder* is quite distinct; the *heart* lies immediately above the liver, enclosed in its pericardium, and consists of a ventricle and two auricles, the left comparatively empty, the right much distended with clots of coagulated blood; the ventricle measures six lines in length by five in breadth; the *œsophagus* communicates with the *stomach* by a large opening; the latter is a large membranous sac, two inches five lines in length, by an inch and a half in breadth at its greater extremity; it occupies, when extended, nearly the whole of the left portion of the abdominal cavity; on cutting into it, it was found to contain numerous Coleoptera, (Trox,) a portion of vegetable matter and the half digested skeleton of a *hyla*. The intestine measures  $14\frac{1}{2}$  inches (Fr.) in length from the pyloric orifice to the commencement of the cloaca, the diameter of which, as usual, is larger than that of the intestine, and measures in length about  $3\frac{1}{2}$  inches. The *ovaries* are of a black color, and contain a great many eggs of a yellow color, of the size of a pin's head; the *lungs* lie posterior to the other viscera, and, when somewhat distended, reach nearly the whole length of the abdominal cavity; the cells, as usual in the frogs, are quite large, and divided by membranous septa; the fatty bodies are much developed, and present numerous subdivisions, thirteen on the right and seven on the left side; there is a very small triangular *spleen*; the *kidneys* are one inch in length by three in breadth. In a specimen of *Ceratophrys*, about half the size of *Trigonophrys*, the liver presented three lobes deeply cleft, but the right lobe was destitute of the trefoil arrangement of the former, the anterior margin being nearly straight, the lobe itself triangular in shape; the specimen having been immersed in strong alcohol, the

viscera are shrunken, but making allowance for this and its smaller size, the stomach appears considerably less, being not more than an inch and a half in length, and the intestine is much shorter, measuring but four inches three lines in length; the fatty bodies are much foliated, the kidneys measuring eight lines, the testes four in length.

*Gen. Remarks.*—The general shape of the head in this genus, resembles very much that of *Ceratophrys*, along side of which it should be placed in a natural arrangement, but it differs from *Ceratophrys* in the form of the eye-lids, which do not terminate in the latter, and the form of the body has no resemblance to that of *Trigonophrys*. The teeth also are different.

In *Megalophrys*, a genus inhabiting Java, and comprising but one species, (*M. montana*,) the first cuneiform bone presents no external prominence, which in *Trigonophrys* is remarkably large. We, therefore, although not having in our collection any of the allied genera, with the exception of *Ceratophrys*, venture to propose for this singular and beautifully colored frog a new name. The maxillary teeth form one of its most striking characters, being larger than those of any species of frog with which we are acquainted, those of the largest bull frog being considerably smaller, as well as those of the large Surinam frogs in our collection. In *Cystignathus ocellatus*, however, the vomerine teeth are much more developed.

# INDEX.

Account of new fish from Florida, Georgia,	47	Anatifa striata,	151
<i>Acer macrophyllum</i> ,	84	Aneides,	344
<i>Acerates cordifolia</i> ,	96	<i>lugubris</i> ,	345
<i>Acteon</i> ,	334	<i>Anisocarpus madaroides</i> ,	92
<i>Actinia marginata</i> ,	140	<i>Anodon radiatus</i> ,	317
<i>neglecta</i> ,	140	<i>Anodonta Holtonis</i> ,	316
<i>Æsculus Californica</i> ,	85	<i>Anomia sellæformis</i>	330
<i>Afer</i> , (s. g.)	332	<i>Anoplanthus fasciculatus</i> ,	99
<i>Agarista calliopsidea</i> ,	91	<i>Anthericum pomeridianum</i> ,	103
<i>Agrostis canina</i> ,	200	<i>Antirrhinum Coulterianum</i> ,	43
<i>Aira flexuosa</i> ,	201	<i>Apedodus</i> ,	164
<i>Alchimella alpina</i> ,	190	<i>priscus</i> ,	165
<i>vulgaris</i> ,	190	<i>Apocynum Androsæmifolium</i> ,	96
<i>Alcionidium pellucidum</i> ,	142	<i>Canadense</i> ,	41
<i>Allium falcifolium</i> ,	102	<i>Aporrhais decemlirata</i> ,	330
<i>Alopecurus alpinus</i> ,	200	<i>Aquilegia formosa</i> ,	80
<i>Ambystoma</i> ,	349	<i>Ara auricollis</i> ,	153
<i>Californiense</i> ,	355	<i>auritorques</i> ,	153
<i>episcopus</i> ,	354	<i>severa</i> ,	153
<i>fuscum</i> ,	355	<i>Arabis alpina</i> ,	186
<i>ingens</i> ,	353	<i>Archangelica hirsuta</i> ,	89
<i>laterale</i> ,	352	<i>Arctostaphylos glauca</i> ,	94
<i>luridum</i> ,	353	<i>Arenaria arctica</i> ,	188
<i>maculatum</i> ,	355	<i>Douglassii</i> ,	83
<i>macrodactylum</i> .	354	<i>Grœnlandica</i> ,	188
<i>maritimum</i> ,	352	<i>Argemone Mexicana</i> ,	37
<i>nebulosum</i> ,	352	<i>muricata</i> ,	37
<i>opacum</i> ,	351	<i>Arnica angustifolia</i> ,	193
<i>porphyriticum</i> ,	351	<i>Asclepias longicornu</i> ,	96
<i>proserpine</i> ,	354	<i>macrophylla</i> ,	41
<i>punctatum</i> ,	349	<i>obtusifolia</i> ,	96
<i>talpoideum</i> ,	352	<i>Aster Durandii</i> ,	91
<i>tigrinum</i> ,	350	<i>falcata</i> ,	91
<i>Ambystomidæ</i> ,	338	<i>Asteracanthus rubens</i> ,	151
<i>Amnodon Snyderi</i> ,	171	<i>Astrangia astræformis</i> ,	139
<i>Anatifa dentata</i> ,	151	<i>Danæ</i> ,	139

Atomic heat, and crystalline form, their relations	105	Campanula prenanthoides, uniflora,	93 194
Aubertia humilis,	100	Campanularia dumosa, volubilis,	138 138
Aulacomnion turgidum,	202	Camelops Kansanus,	166
Azalea Californica, grandiflora,	94 37	Calamagrostis Canadensis, Mexicana, stricta,	104, 200 104 200
Baculites ovata, Spillmani, Tippaensis,	334 335 334	Caligus ?	150
Balanus balanoides,	151	Calliprora lutea,	102
Bartsia alpina,	195	Callichroa platiglossa,	92
Bartonia lævicaulis,	88	Calliachrysis Fremontii, tenella,	92 92
Batrachocephalus, attenuatus, quadridigitatus,	348 348 348	Callochortus elegans, venustus	101 101
Bellerophon Montfortianus, percarinatus, Urii,	74 74 75	Calycadenia truncata, Caprella ?	92 150
Berberis aquifolium,	80	Carcinus mœnas,	149
Betula nana,	197	Cardamine paucifolia, pratensis,	80 186
Boleosoma Barratti,	56	Cardium Spillmani, tenuissimum, Tippanum,	326 326 326
Bolitoglossidæ,	338	Carex rigida,	199
Boletus strobilaceus,	207	Cassiope tetragona,	194
Bowerbankia densa, gracilis,	143 142	Castilleja candens,	43
Boykinia occidentalis,	89	Catabrosa aquatica,	200
Bradybates, Poiræti, ventricosus,	341 341 342	Ceanothus cuneatus, papillosus, prostratus, rigidus, sordeanus,	85 85 85 85 85
Brodiaea congesta, grandiflora,	102 102	Cellularia fastigiata,	42
Bromus Kalmii,	201	Cellulose, varieties of,	60
Brotogeris aurifrons, chrysoptera,	155 155	Cephalanthus occidentalis,	90
Brunella vulgaris,	100	Cepon distortus,	150
Bryttus fasciatus, gloriosus,	51 52	Cerasus demissa,	87
Bryum lucidum, Muhlenbergii,	202 202	Cerastium Alpinum, Fischerianum, uniflorum,	189 189 189
Burrielia gracilis,	92	Cetraria ciliaris, Islandica, placoridia,	104 203 104
Byssosarca,	327	Chamæbatia foliosa,	87
California plants,	79	Chemnitzia distans,	333
Calliurus Floridanus,	53		
Campanula latifolia,	193		



# INDEX.

373

Chemnitzia interrupta,	333	Cornus sessilis,	89
Chenactes heterocarpha,	92	Crangon septemspinosus,	150
Chlamydococcus pluvialis,	59	Crassatella Ripleyana,	327
Chlorogalum pomeridianum,	103	Cretaceous fossils,	323
Chonetes armata,	23, 28	Crystalline form, its relation to atomic heat,	105
cornuta,	23	Cryptogamic flora of Georgia,	59
Fischeriana,	24	Utenoides acutilineata,	329
Flemingii,	26	Cuculea capax,	328
granulifera,	24	Tippana,	328
Koninckiana,	30	Cuscuta subinclusa,	42
Littonii,	24	Cyclobothium alba,	101
Loganii,	30	pulchella,	101
mesoloba,	26	Cynoglossum grande,	97
sarcinulata,	23, 28	Cytherina Tippana,	335
setigera,	23	Cystopterus fragilis,	201
Shumardiana,	23, 24		
Maclurea,	28	Description of fossil fish,	159
Martini,	29	Dewya arguta,	89
nana,	28	Diapensia lapponica,	196
variolata,	28	Dichelostemma congestum,	102
Verneuilliana,	26	Diclytra formosa,	80
Tuomyi,	28, 29	Dicranum elongatum,	202
Chryseis Californica,	80	falcatum ?	203
Chrysotis autumnalis,	153	Muhlenbergii,	203
viridigenalis,	153	Richardsonii,	203
Cibota lintea,	328	scoparium,	202
Cirrhatulus fragilis,	147	Starkii aff.,	203
Clava multicornis,	135	virens,	203
Cladonia furcata,	204	Diemyctylus,	262
rangifera,	204	miniatus,	363
pyxidata,	204	viridescens,	363
Clarkia rhomboidea,	88	Dodecatheon dentatum,	95
Clymene torquatus,	146	ellipticum,	94, 95
urceolatus,	145	integrifolium,	95
Cochlearia anglica,	188	meadia,	95
fenestrata,	188	pauciflora,	95
officinalis,	188	Dosinia densata,	328
Collinsia bartisiæfolia,	98	Draba alpina,	186
bicolor,	98	glacialis,	186
parviflora,	97	hirta,	186
tinctoria,	98	incana,	186
Collomia gilioides,	97	lapponica,	186
grandiflora,	97	nivalis,	186
Contributions to South American Herpetology,	33	rupestris,	186
Conus canales,	331	Dreissena polymorphæ,	328
Corethrogyne tomentella,	40	Tippana,	328
Cornus Nuttallii,	89	Drillia novemcostata,	331

Drillia Tippiana,	331	Eucoryne,	136
Dryas integrifolia,	190	elegans,	136
octopetala,	188	Eudosmia Gairdneri,	88
Dryopteris, ( <i>Lastræa</i> ),	104	Eunanus Douglassii,	98
dilatata,	104	Tolmæii,	98
intermedia,	104	Eunice sanguinea,	147
		Euphorbia ocellata,	46
Echeandia tenuifolia,	103	Euproctus,	356
Echinus granulatus,	151	Rusconi,	356
Edestus,	159	poireti,	357
vorax,	159	Evernia vulpina,	194
Elaphoides fasciatus,	35	Exogyra interrupta,	330
fuscus,	35		
Ellipsoglossa,	365	Festuca duriuscula?	104
nævia,	365	ovina,	200
Elaps divaricatus,	36	Richardsonii?	200
tenere,	36	Ficus octoliratus,	332
zonatus,	35	Fish, fossil,	159
Ellipsoglossidæ,	339	new, from Florida and Georgia,	47
Elisia chrysanthemifolia,	97	Flustra <i>lineata</i> ,	140
microcalyx,	97	Foot prints of articulata,	176
Elymus arenarius,	201	batrachia,	175
Empetrum nigrum,	196	birds,	174
Epilobium angustifolium,	191	saurian,	174
latifolium,	191	Fossils, carboniferous series,	11
Equisetum arvense,	201	chonetes,	23—32
Eriogonum dichotomum,	100	cretaceous,	323
fasciculatum,	44	producti,	5—22
geniculatum,	45	Western States and Territories,	5—23
nudum,	100	Fritillaria lanceolata,	101
plumatella,	45	parviflora,	102
Prattenianum,	100	Frasera albicaulis,	96
vimineum,	100	nitida,	96
Erigeron Douglassii,	91	Fumaria <i>formosa</i> ,	80
Eriodyction glutinosum,	97	Fusus <i>afer</i> ,	332
Eriophorum capitatum,	199	bellaliratus,	332
polystachion,	199	inhabilis,	76
vaginatum,	199	novemliratus,	332
Erodium cicutarium,	84	Gebia affinis,	150
Erysimum Arkansanum,	81	Gelasimus minax,	149
asperum,	81	pugillator,	149
elatum,	81	Geotriton,	348
Erythræa Muhlenbergii,	42, 96	fuscus,	348
tricantha,	42	Gervillia ensiformis,	328
Escharina lineata,	141	solenoides,	329
pediostoma,	141	Gilia (chrysantha) capitata,	97
variabilis,	142	elongata,	42

# INDEX.

375

<i>Gilia</i> ( <i>chrysantha</i> ) <i>filipes</i> ?	97	<i>Hypnum</i> <i>Schreberi</i> ,	203
<i>grandiflora</i> ,	97	<i>stramineum</i> ,	203
<i>tricolor</i> ,	97	<i>uncinatum</i> ,	203
<i>Glæoporus</i> ,	209	<i>Hypolyssus</i> ,	205
<i>Glycera Americana</i> ,	147	<i>Hyria</i> ,	320
<i>Glyceria Artica</i> ,	200	<i>Idotea irrorata</i> ,	150
<i>Gnaphalium sylvaticum</i> ,	193	<i>triloba</i> ,	150
<i>Grantia botryoides</i> ,	135	<i>Inoceramus argenteus</i> ,	321
<i>ciliata</i> ,	135	<i>costellatus</i> ,	321
Greenland plants,	179	<i>Irpex cinnamomeus</i> ,	216
tables of,	182, 183, 184	<i>obliquus</i> ,	217
<i>Guepinia spathularia</i> ,	207	<i>pallens</i> ,	215
<i>Guttierhiza microphylla</i> ,	40	<i>porinoides</i> ,	215
<i>Gymnadenia longispica</i> ,	101	<i>rufus</i> ,	215
		<i>serpens</i> ,	216
<i>Harpago Tippanus</i> ,	331	<i>strigoso-zonatus</i> ,	214
<i>Harpæcarpus madaroides</i> ,	92	<i>Isocardia Moltkiana</i> ,	319
<i>Heliomeris simplex</i> ,	91		
<i>Hemidactylidæ</i> ,	339	<i>Juncus Arcticus</i> ,	198
<i>Hemidactylum</i> ,	365	<i>trifidus</i> ,	198
<i>scutatum</i> ,	366	<i>Jungermannia divaricata</i> ,	203
<i>Heringia</i> ,	205	<i>squarrossa</i> ,	203
<i>Hesperis Pallasii</i> ,	186	<i>Juniperus Virginiana</i> ,	101
<i>Hesperoscordon lacteum</i> ,	102		
<i>Heterodon rarifolium</i> ,	94	<i>Lævicardium</i> ,	326
<i>Hieracium molle</i> ,	193	<i>Larrea Mexicana</i> ,	38
<i>vulgatum</i> ?	193	<i>glutinosa</i> ,	38
<i>Hippa talpoidea</i> ,	149	<i>Lathyrus decaphyllus</i> ,	85
<i>Holoptichus</i> ,	162	<i>venosus</i> ,	85
<i>Americanus</i> ,	163	<i>Laomedia dichotomum</i> ,	138
<i>nobilissimus</i> ,	163	<i>gelatinosum</i> ,	138
<i>Hordeum pusillum</i> ,	104	<i>Layia Fremontii</i> ,	92
<i>Hosackia bicolor</i> ,	86	<i>Ledum</i> ,	111
<i>brachycarpa</i> ,	86	<i>Legumen</i> ,	325
<i>decumbens</i> ,	39	<i>ellipticus</i> ,	325
<i>grandiflora</i> ,	86	<i>Leimanthemum Nuttallii</i> ,	103
<i>Heermannii</i> ,	39	<i>Lentinus Schweinitzii</i> ,	206
<i>lathyroides</i> ,	38	<i>Lenzites abietina</i> ,	214
<i>Purshiana</i> ,	86	<i>Berkeleii</i> ,	214
<i>subpinnata</i> ,	86	<i>separia</i> ,	214
<i>Hyas coarctata</i> ,	149	<i>trabea</i> ,	214
<i>Hydractina echinata</i> ,	135	<i>Lepidonote armadillo</i> ,	148
<i>Hygrophorus cinnabarinus</i> ,	206	<i>Lepralia pediosoma</i> ,	141
<i>Hypericum Scouleri</i> ,	85	<i>Leptosyne Douglassii</i> ,	91, 92
<i>Hypnum cordifolium</i> ,	203	<i>Stillmanii</i> ,	91
<i>viparium</i> ,	203	<i>Leucophrys clavata</i> ,	144
<i>sarmentosum</i> ,	203	<i>cochleariformis</i> ,	144

<i>Ligia</i> — ?	150	<i>Meckelia ingens</i> ,	143
<i>Lilium superbum</i> ,	102	<i>Membranipora pilosa</i> ,	141
<i>Lima glacialis</i> ,	329	<i>Mentzelia lævicaulis</i> ,	88
<i>scabra</i> ,	329	<i>Meretrix Tippana</i> ,	326
<i>Wacoensis</i> ,	329	<i>Mertinsia maritima</i> ,	195
<i>Limnanthes alba</i> ,	84	<i>Merulius Brassicæfolius</i> ,	215
<i>Douglassii</i> ,	84	<i>corium</i> ,	207, 215
<i>Limnoria terebrans</i> ,	150	<i>crispatus</i> ,	215
<i>Loiseluria procumbens</i> ,	194	<i>fugax</i> ,	215
<i>Lotus pinnatus</i> ,	38, 86	<i>Himantioides</i> ,	215
<i>Loxonema Hallii</i> ,	77	<i>incarnatus</i> ,	206
<i>Lumbriconereis splendida</i> ,	147	<i>lachrymans</i> ,	215
<i>Lumbriculus tenuis</i> ,	148	<i>molluscus</i> ,	214
<i>Lunantia rectilabrum</i> ,	334	<i>pallens</i> ,	215
<i>Lupa dicantha</i> ,	149	<i>porinoides</i> ,	215
<i>maculata</i> ,	149	<i>rufus</i> ,	215
<i>Lupinus albicaulis</i> ,	86	<i>serpens</i> ,	215
<i>concinus</i> ,	86	<i>strigoso-zonatus</i> ,	214
<i>Douglassii</i> ,	86	<i>tremulosus</i> ,	214
<i>falcifer</i> ,	86	<i>vastator</i> ,	214
<i>labiatus</i> ,	86	<i>Mimulus cardinalis</i> ,	98
<i>latifolius</i> ,	86	<i>exilis</i> ,	43
<i>nanus</i> ,	86	<i>luteus</i> ,	98
<i>rivularis</i> ,	86	<i>moschatus</i> ,	98
<i>Luzula arcuata</i> ,	193	<i>Prattenii</i> ,	98
<i>campestris</i> ,	104	<i>Schouleri</i> ,	98
<i>hypoborea</i> ,	198	<i>Molgidæ</i> ,	339
<i>spicata</i> ,	198	<i>Monardella candicans</i> ,	98
<i>Lychnis apetala</i> ,	189	<i>Sheltoni</i> ,	99
<i>Alpina</i> ,	189	<i>Monocondylæa Paraguayana</i> ,	319
<i>pauciflora</i> ,	189	<i>Monolopia Bahiæfolia</i> ,	93
<i>Lycopodium annotinum</i> ,	201	<i>Heermannii</i> ,	93
<i>Alpinum</i> ,	201	<i>lanceolata</i> ,	93
<i>selago</i> ,	201	<i>Musculites</i> ,	329
<i>Lynosyris ceruminosa</i> ,	40	<i>Mycetoglossus</i> ,	347
<i>teretefolia</i> ,	41	<i>Mytilus falcatus</i> ,	328
<i>Macrorhynchus heterophilus</i> ,	93		
<i>retrorsus</i> ,	93	<i>Natica rectilabrum</i> ,	334
<i>troximoides</i> ,	93	<i>ventrica</i> ,	76
<i>Macrocheilus inhabilis</i> ,	76	<i>Nautilus Alabamensis</i> ,	335
<i>Madaria corymbosa</i> ,	92	<i>angustatus</i> ,	335
<i>Malacothrix tenuifolia</i> ,	93	<i>orbiculatus</i> ,	335
<i>Malvastrum marrubioides</i> ,	38	<i>Vanuxemi</i> ,	335
<i>Marasmius hematocephalus</i> ,	306	<i>Navicula</i> ,	328
<i>Marine invertebrata of Rhode Island and</i>		<i>Navarretia pubescens</i> ,	97
<i>New Jersey</i> ,	135	<i>squarrosa</i> ,	97

# INDEX.

377

Narragansetta,	144	Paxillus Curtisii,	207
coralii,	144	panuoides,	207
Navarretia odoratissima,	100	Pechnaria auricoma,	146
Nemertes socialis,	143	Pedicellina Americana,	143
Nemophila insignis,	96	Pedicularis arctica,	195
maculata,	96	hirsuta,	195
Nereis denticulata,	148	Kanei,	195
Notice of Chonetes of the Western States,	23	lunata,	196
Fossils of the carboniferous series,	71	Peltigera canina,	204
Producti of the Western States,	5	Pentstemon heterophyllus,	98
Nucula percrassa,	327	Pentremites florealis,	71
		pyriformis,	71
Ocypode arenaria,	149	sulcatus,	71
Odontia fimbriata,	217	Periploma applicata,	324
Oenothera biennis,	87	Petalodus Alleghaniensis,	161
biloba,	87	Peucedanum utriculatum,	89
decumbens,	87	Phalangium croceum,	103
Lindleyi,	39	Phippsias algida,	200
purpurea,	88	Phlox divaricata,	97
rubicunda,	87	Pholadis,	329
Onychodactylus,	356	Pholodomya Tippiana,	324
Schlegelii,	356	Phorodendron juniperinum,	90
Ophelia simplex,	148	Phyllodoce taxifolia,	194
Opis bicarinata,	327	Pickeringia montana,	86
bella,	327	Pimelodus marmoratus,	54
Oranthus vetustus,	161	Pinna laqueata,	328
Orchestia gryllus,	150	Pinnotheres maculatum,	149
Orobanche fasciculata,	99	ostreum,	149
Orthocarpus lacerus,	98	Plagiodon,	317
purpurascens,	98	isocardioides,	318
Osmorhiza orachypoda,	89	Planaria frequens,	143
Ostrea confragosa,	330	Plantæ Kaneanæ Grœnlandica,	179
denticulifera,	330	Plants, new from California,	37
peculiaris,	329	Plantanthera hypoborea,	198
Oxyria digyna,	190	Platycarcinus ocellatus,	149
		Sayi,	149
Pagurus longicarpus,	149	Plectritis congesta,	90
pollicaris,	149	Plethodon,	342
Palæornis Gironieri,	156	auriculatum,	344
viridicollis,	156	glutinosus,	344
Panopeus Herbsti,	149	erythronotus,	343
Wurdmanii,	149	niger,	344
Panus angustatus,	206	Plethodontidæ,	338
stypticus,	206	Pleurodeles,	341
Papaver nudicaule,	186	Watli	341
Papyridia bella,	326	Pleurodelidæ,	337
elegantulum,	326	Pleurotomaria carbonaria,	75
protectum,	326	Grayvillensis,	75
Paxillus,	214	Poa Alpina,	200

<i>Poa Arctica</i> ,	200	<i>Polyporus dryophilus</i> ,	211
<i>Pogogyne parviflora</i> ,	100	<i>farinellus</i> ,	213, 214
<i>Polygala cuculata</i> ,	81	<i>ferruginosus</i> ,	211
<i>Polygonum viviparum</i> ,	196	<i>fimbriporus</i> ,	208
<i>Polyphemus occidentalis</i> ,	150	<i>floridanus</i> ,	224
<i>Polypodium phegopteris</i> ,	201	<i>fomentarius</i> ,	207
<i>vulgare</i> ,	104	<i>fuliginus</i> ,	207
<i>Polyporus abietinus</i> ,	209	<i>fuliginosus</i> ,	207
<i>adustus</i> ,	209	<i>fumosus</i> ,	208
<i>affinis</i> ,	210, 224	<i>fusco-albus</i> ,	208
<i>alutaceus</i> ,	208	<i>fusco-gilvus</i> ,	210
<i>amorphus</i> ,	209	<i>gilvus</i> ,	210
<i>aneirinus</i> ,	214	<i>graveolus</i> ,	208
<i>annosus</i> ,	208, 210, 211	<i>hypococcinus</i> ,	211
<i>arcularius</i> ,	207	<i>igniarius</i> ,	210, 211
<i>badius</i> ,	207	<i>incarnatus</i> ,	212
<i>benzoinus</i> ,	210	<i>internus</i> ,	214
<i>betulinus</i> ,	208	<i>Juglandis</i> ,	211
<i>brumalis</i> ,	207	<i>labarynthicus</i> ,	208
<i>brunneus</i> ,	214	<i>lacteus</i> ,	208
<i>byrsinus</i> ,	224	<i>leptocephalus</i> ,	207
<i>calceus</i> ,	213	<i>lobatus</i> ,	211
<i>callosus</i> ,	213	<i>lucidus</i> ,	208
<i>Caryæ</i> ,	213	<i>marginatus</i> ,	210
<i>cervino-nitens</i> ,	224	<i>medulla panis</i> ,	209
<i>chioneus</i> ,	208	<i>Menandrianus</i> ,	209
<i>ciliatus</i> ,	207	<i>mollis</i> ,	208
<i>cinereus</i> ,	212	<i>molluscus</i> ,	213
<i>cinnabarinus</i> ,	210	<i>Nieskyensis</i> ,	209
<i>cinnamomeus</i> ,	207	<i>nidulans</i> ,	210, 211
<i>cœsius</i> ,	208	<i>nigromarginatus</i> ,	209
<i>colliculosus</i> ,	213	<i>nigropurpurascens</i> ,	208, 212
<i>compressus</i> ,	210	<i>nigropurpureus</i> ,	212
<i>conchatus</i> ,	210	<i>nitidus</i> ,	212
<i>conchifer</i> ,	210	<i>occidentalis</i> ,	224
<i>congoblatus</i> ,	208	<i>obducens</i> ,	213
<i>connatus</i> ,	207	<i>pallescent</i> ,	209
<i>contiguus</i> ,	211	<i>papyraceus</i> ,	213
<i>crispus</i> ,	209	<i>parvulus</i> ,	207, 210
<i>crocatus</i> ,	214	<i>perennis</i> ,	209
<i>crociporus</i> ,	209	<i>pergameneus</i> ,	207
<i>cupreus</i> ,	214	<i>Pilotæ</i> ,	209, 211
<i>Curtisii</i> ,	208	<i>Pini-Canadensis</i> ,	211
<i>cuticularis</i> ,	210	<i>populinus</i> ,	209, 210
<i>decipiens</i> ,	210	<i>poroides</i> ,	209, 210
<i>dentiporus</i> ,	213	<i>pulchellus</i> ,	212
<i>destructor</i> ,	208	<i>radiatus</i> ,	209, 210
<i>dichrous</i> ,	209	<i>radicatus</i> ,	207
<i>dryadeus</i> ,	210	<i>radula</i> ,	213

# INDEX.

379

Polyporus	recticulatus,	213, 214	Pomotis speciosus,	47
	rhodellus,	212	Pontonema,	144
	Rhododendri,	212	marinum,	144
	rufescens,	207, 216	vaccillatum,	144
	rufus,	211	Prioniturus discurus,	155
	rutilans,	210	flavicans,	155
	salicinus,	211	platurus,	155
	sanguineus,	210, 214	Procyon priscus,	169
	sanguinolentus,	213	Productus Altonensis,	6
	Sassafras,	212	Boliviensis,	11, 16
	Schweinitzii,	207	Bucheanus,	20
	scruposus,	209, 210, 211	Carbonarius,	11
	scutellatus,	210	clavus,	10
	sinuosus,	212	cora,	6, 7
	spissus,	211, 212	costatus,	11
	spongiosus,	211	elegans,	11, 72
	spumeus,	208	fimbriatus,	19
	Stephensii,	212	Flemingii,	11
	stereoides,	209	flexistria,	6, 14
	stypticus,	208	genuinus,	10
	subspadiceus,	211	granulosus,	21
	Sulivantia,	209	Hildrethianus,	18
	superficialis,	211, 212	Leuchtenbergensis,	19
	tabulæformis,	207	marginalis,	6
	tenuis,	213	Margaritaceus,	6
	terrestis,	213	Murchisonianus,	6, 21
	tuberculosus,	213	muricatus,	14
	ulmarius,	209	Phillipsii,	7
	umbrinus,	212	Portlockianus,	15, 16
	undatus,	211	Prattenianus,	17
	undulatus,	208	proboscideus,	10
	unitus,	212	punctatus,	19, 20
	vaporarius,	213, 217	Rogersii,	9
	varius,	207	scabriusculus,	17
	velutinus,	209, 224	semireticulatus,	7, 11
	versicolor,	210	splendens,	11, 13
	virgineus,	209, 210	subaculeatus,	21
	vitellinus,	212	undatus,	9
	viticola,	211	undiferus,	9
	vitreus,	213	Villiersii,	17
	vulgaris,	213	Wabashensis,	13
	xanthus,	211, 212	Pseudotriton,	347
	xantholoma,	212, 213	ruber,	347
	xylostromeus,	214, 215	salmonea,	347
Polytrichum	Juniperinum,	202	Psittacidæ, new species of,	153
Pomotis	elongatus,	47	Psittacula lineola,	154
	marginatus,	48	passerina,	154



<i>Psoralea orbicularis</i> ,	85	<i>Saxifraga tricuspidata</i> ,	192
<i>Pterocera</i> ,	331	<i>Virginensis</i> ,	88
<i>Ptilidium ciliare</i> ,	203	<i>Scaphites Conradi</i> ,	223, 335
<i>Pulvinites Adansonii</i> ,	330	<i>iris</i> ,	335
<i>Pulvinites argentea</i> ,	230	<i>Scirpus cæspitosus</i> ,	199
<i>Pycnanthemum Californicum</i> ,	99	<i>Schizophyllum commune</i> ,	207, 224
<i>Pycnogonum</i> ,	150	<i>ramosum</i> ,	224
<i>Pyrifusus</i> ,	332	<i>Schœnolirion album</i> ,	103
<i>subdensatus</i> ,	332	<i>Scutellaria angustifolia</i> ,	100
		<i>tuberosa</i> ,	100
<i>Racomitrum lanuginosum</i> ,	203	<i>Sedum rhodiola</i> ,	191
<i>Ranunculus aquatilis</i> ,	185	<i>Seiranota</i> ,	340
<i>glacialis</i> ,	185	<i>perspicillata</i> ,	340
<i>nivalis</i> ,	185	<i>Seiranotidæ</i> ,	337
<i>Rapa supraplicata</i> ,	332	<i>Senbertia laxa</i> ,	192
<i>Rhododendron Lapponicum</i> ,	194	<i>Seriocarpus Californicus</i> ,	90
<i>Rimella ? curvilirata</i> ,	331	<i>Sertularia cupressina</i> ,	138
<i>Rosa blanda</i> ,	87	<i>Sesarma cinera</i> ,	149
<i>gymnocarpa</i> ,	87	<i>reticulata</i> ,	149
		<i>Sicarius extinctus</i>	161
<i>Sabella oculifera</i> ,	145	<i>Sidalcea Hartwegi</i> ,	84
<i>Salamandra</i> ,	339	<i>Sigaleon Mathildæ</i> ,	148
<i>atra</i> ,	340	<i>Silene acaulis</i> ,	189
<i>corsica</i> ,	340	<i>Californica</i> ,	83, 84
<i>perspicillata</i> ,	340	<i>Greggii</i> ,	83
<i>Salamandridæ</i> ,	337	<i>multicaule</i> ,	84
<i>Salix arctica</i> ,	197	<i>regia</i> ,	83
<i>desertorum</i> ,	197	<i>rotundifolia</i> ,	83
<i>herbacea</i> ,	198	<i>Virginica</i> ,	83
<i>lobata</i> ,	82	<i>Siliquaria biplicata</i> ,	324
<i>uva-ursi</i> ,	197	<i>Siphonostomum affine</i> ,	148
<i>Sambucus velutina</i> ,	38	<i>Solidago Californica</i> ,	91
<i>Sandstone fossils of Connecticut</i> ,	173	<i>Solidulus linteus</i> ,	234
<i>Sanicula bipinnatifida</i> ,	89	<i>Spelerpes</i> ,	345
<i>Sarcocyphus Erhartii</i> ,	203	<i>bi-lineata</i> ,	346
<i>Saxifraga aizoides</i> ,	192	<i>cirrigera</i> ,	346
<i>aizoon</i> ,	192	<i>gutto-lineata</i> ,	346
<i>cæspitosa</i> ,	192	<i>Haldemanni</i> ,	347
<i>cernua</i> ,	193	<i>longicauda</i> ,	345
<i>cordifolia</i> ,	88	<i>Spermestes fuscans</i> ,	60
<i>Eschscholtzii</i> ,	191	<i>nigriceps</i> ,	60
<i>flagellaris</i> ,	192	<i>Sphagnum acutifolium</i> ,	202
<i>foliosa</i> ,	192	<i>recurvum</i> ,	202
<i>nivalis</i> ,	192	<i>squarrosum</i> ,	202
<i>oppositifolia</i> ,	191	<i>Spiræa Douglassii</i> ,	87
<i>peltata</i> ,	88	<i>multiflora</i> ,	87
<i>rivularis</i> ,	193	<i>opuliolia</i> ,	87

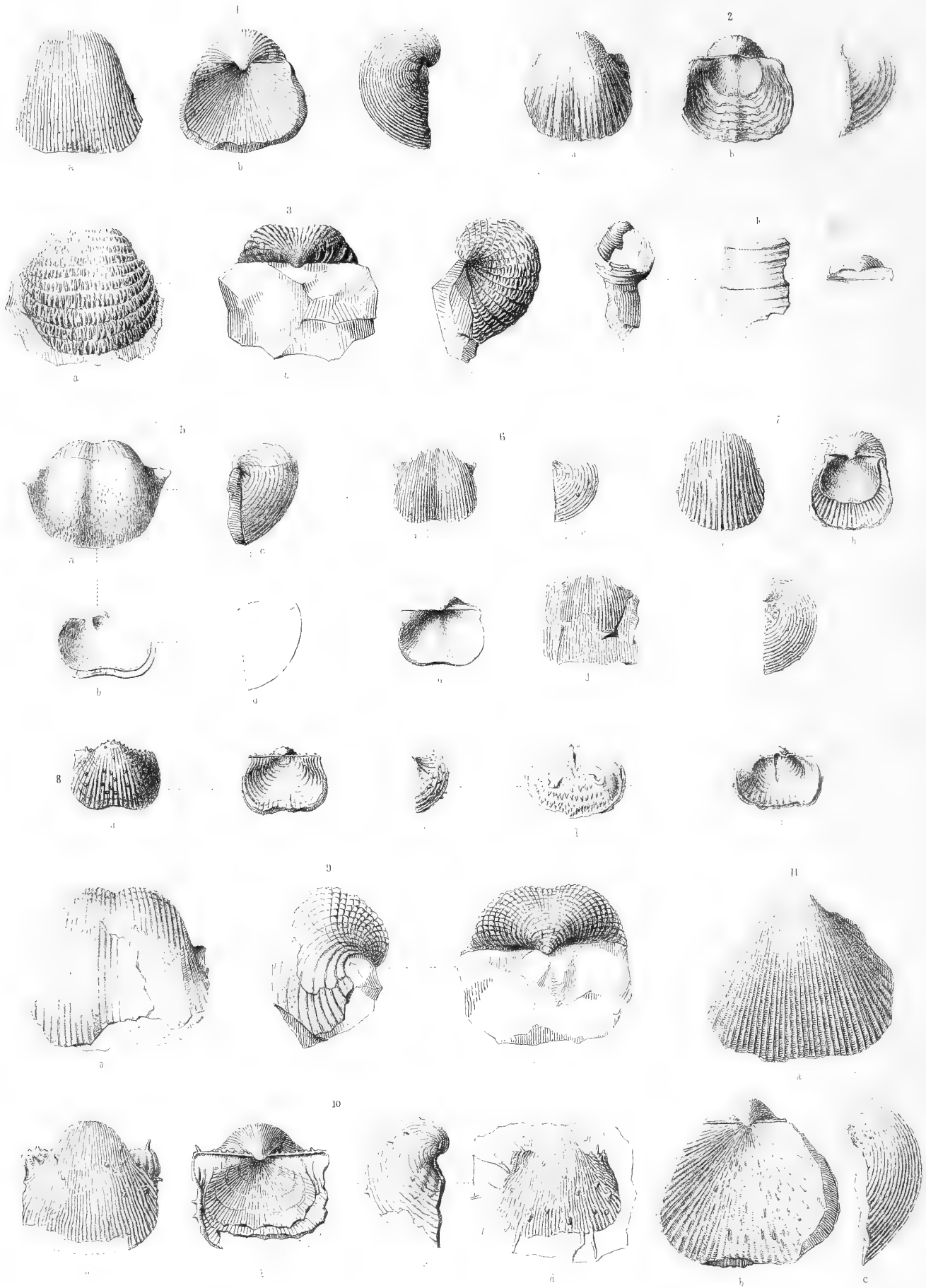
# INDEX.

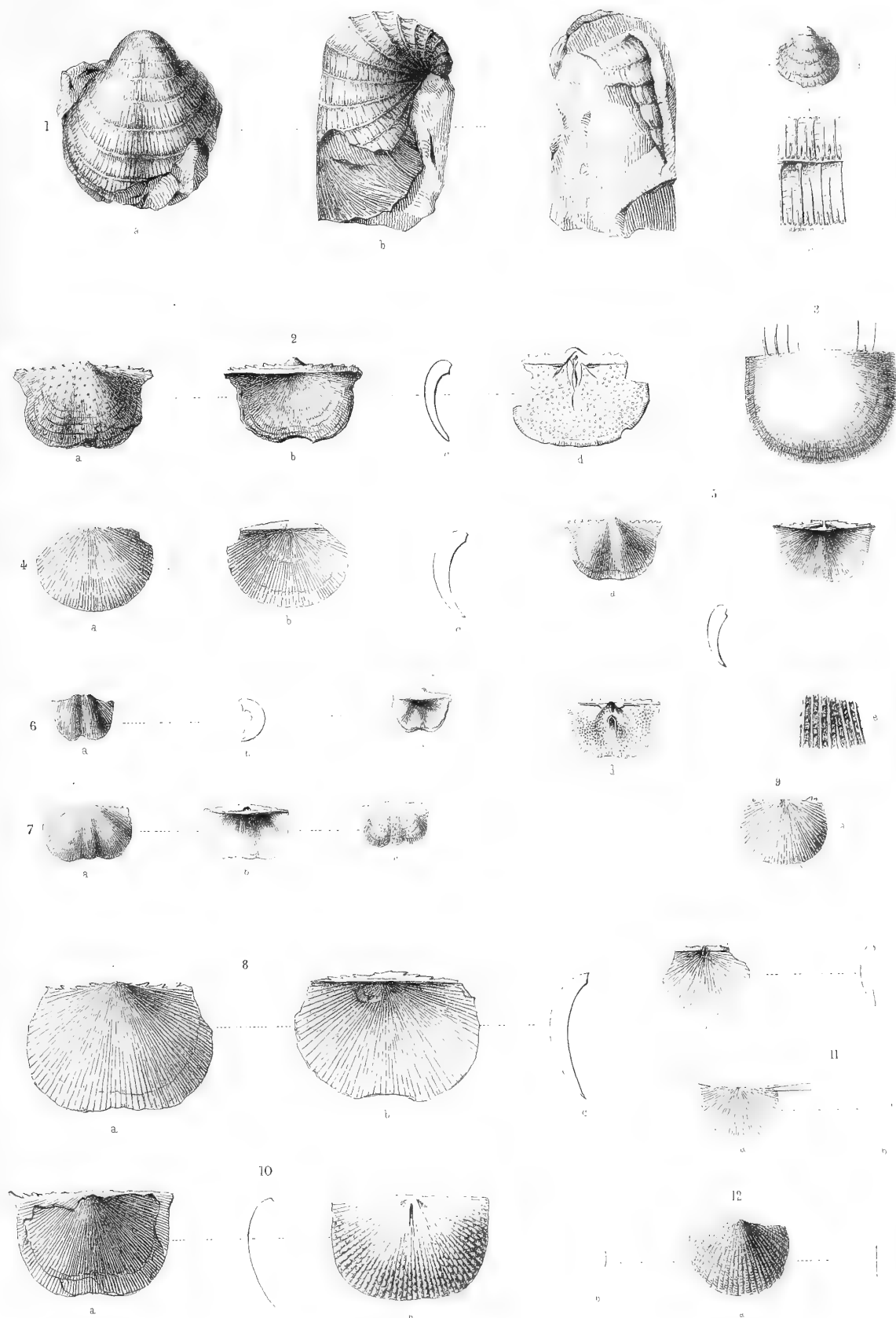
381

<i>Spiranthus bracteosa</i> ,	101	<i>Trillium sessile</i> ,	103
<i>Spirifer Fisherianus</i> ,	72	<i>Triquetra contorta</i> ,	319, 321
<i>Forbesii</i> ,	73	<i>lanceolata</i> ,	319, 321
<i>Leidyi</i> ,	72	<i>Trisetum subspicatum</i> ,	201
<i>spinosus</i> ,	71, 72	<i>Tritomegas</i> ,	357
<i>tricornis</i> ,	8	<i>Sieboldii</i> ,	357
<i>Splachnum vasculosum</i> ,	202	<i>Triton</i> ,	358
<i>Wormskioldii</i> ,	202	<i>alpestris</i> ,	358
<i>Spondiolithus</i> ,	329	<i>cristatus</i> ,	358
<i>Spraguea umbellata</i> ,	84	<i>marmoratus</i> ,	359
<i>Squilla empusa</i> ,	150	<i>nyctimerus</i> ,	341, 360
<i>Stachys Prattenii</i> ,	100	<i>palmatus</i> ,	360
<i>pilosæ</i> ,	100	<i>punctatus</i> ,	360
<i>Stanleya integrifolia</i> ,	38	<i>Pyrenæus</i> ,	361
<i>Stellaria humifusa</i> ,	188	<i>subcristatus</i> ,	362
<i>longipes</i> ,	188	<i>vittatus</i> ,	361
<i>Stenodactylus fuscus</i> ,	33	<i>Tritonidæ</i> ,	338
<i>Stenacanthus</i> ,	164	<i>Turris Ripleyana</i> ,	332
<i>nitidus</i> ,	164	<i>Turritella Tippana</i> ,	333
<i>Strobilomyces</i> ,	207	<i>Unio acutissimus</i> ,	297
<i>Strombus densatus</i> ,	333	<i>Africanus</i> ,	300
<i>Symphoricarpus racemosus</i> ,	89	<i>alatus</i> ,	295, 314
<i>Synopsis Fungorum</i> ,	205	<i>aratus</i> ,	313
Table of Chonetes of the Western States, &c.,	32	<i>Batavus</i> ,	301
of compound bodies,	113, 114	<i>Brownei</i> ,	307
of elementary bodies,	111, 114	<i>Burroughianus</i> ,	308, 309
of Greenland plants,	182, 183, 184	<i>cæruleus</i> ,	294, 300, 303
of Producti of the Western States, &c.,	22	<i>caffer</i> ,	301, 302
<i>Taraxacum palustre</i> ,	193	<i>charruanus</i> ,	310
<i>Taricha</i> ,	357	<i>Cailliaudii</i> ,	298
<i>torosus</i> ,	357	<i>Coloradoensis</i> ,	314
<i>Tellina Ripleyana</i> ,	327	<i>Cambodiensis</i> ,	313
<i>Terebella ornata</i> ,	146	<i>confertus</i> ,	302
<i>Thymus serpyllum</i> ,	196	<i>corrugatus</i> ,	292, 294
<i>Tornatella</i> ,	334	<i>crispatus</i> ,	296, 297, 299, 303, 307
<i>Torquea</i> ,	146	<i>crocatus</i> ,	314
<i>eximia</i> ,	146	<i>cylindricus</i> ,	316
<i>Trametes malicola</i> ,	209	<i>delodontus</i> ,	309
<i>Trichostemma lanceolatum</i> ,	44, 100	<i>delphinus</i> ,	291
<i>oblongum</i> ,	100	<i>Dunkerianus</i> ,	305
<i>Trichotropis? cancellaria</i> ,	333	<i>effulgens</i> ,	303
<i>Trientalis latifolia</i> ,	96	<i>ellipticus</i> ,	304
<i>Trifolium fimbriatum</i> ,	86	<i>eximius</i> ,	294
<i>Trigonophrys</i> ,	367	<i>gratiosus</i> ,	297, 299, 303
<i>nigiceps</i> ,	367	<i>gravidus</i> ,	292

Unio Hainesianus,	289	Unio Shurtleffianus,	302
Hopetonensis,	305	sauvidicus,	309
Housei,	290, 291	substriatus,	300
humilis,	296, 297	superbus,	289, 293
inornatus,	293, 300	Tampicoensis,	312, 315
Javanus,	294	Tavoyensis,	292, 294
Ingallsianus,	298, 300	Tigris,	296
Keraudreni,	311	tumidulus,	295
lacteolus,	309	umbrosus,	300, 311
luteus,	291	Verreauianus,	301
membranaceus,	309	Wheatleyanus,	308
Murchinsonianus,	294	Ursus amplidens,	168
Myersianus,	290	Vaccinium uliginosum,	194
Newcombianus,	312	Valkeria pustulosa,	143
Nicklinianus,	295	Veratrum Californianum,	103
nucleus,	297, 300, 306	Vesicaria Arctica,	186
Nuttallianus,	310	Viola Beckwithii,	82
olivaceus,	311	Voluta Lamberti,	333
Paranensis,	289, 308	Volutilithes cretacea,	333
parvus,	300	Weissia crispula,	203
phaseolus,	299, 299	Woodsia Ilvensis,	201
Poeyanus,	315	Woodwardia Chamissonii,	104
Popeii,	316	Ximenesia encelloides,	92
purpuratus,	314	Zameris tricolor,	34
rhuocoica,	306	viridiflavus,	34
rusticus,	294, 296	Zauschneria Californica,	87
sagittarius,	298	Zygophyllum tridentatum,	38
scobinatus,	299		
Shuttleworthii,	304		

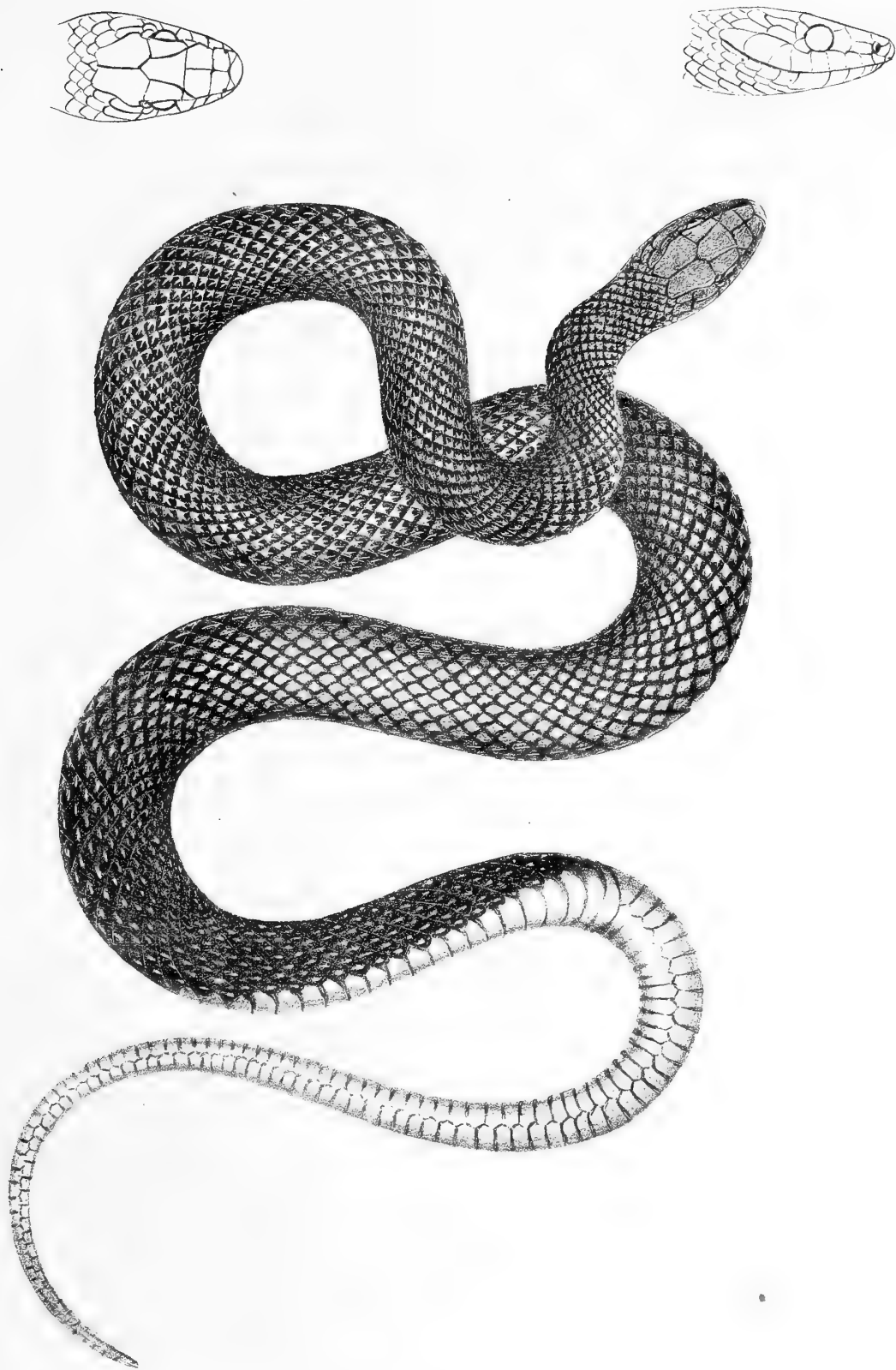




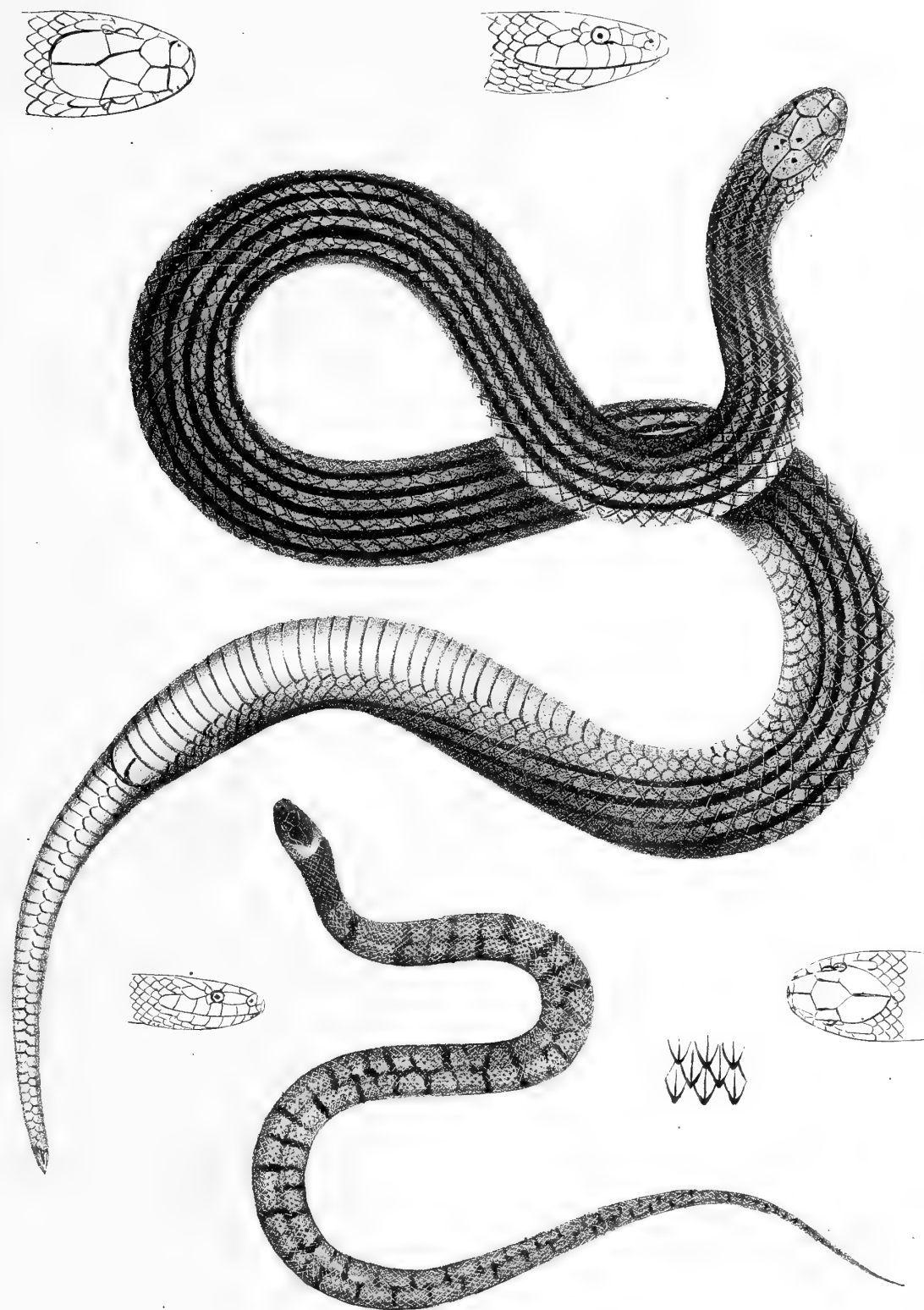




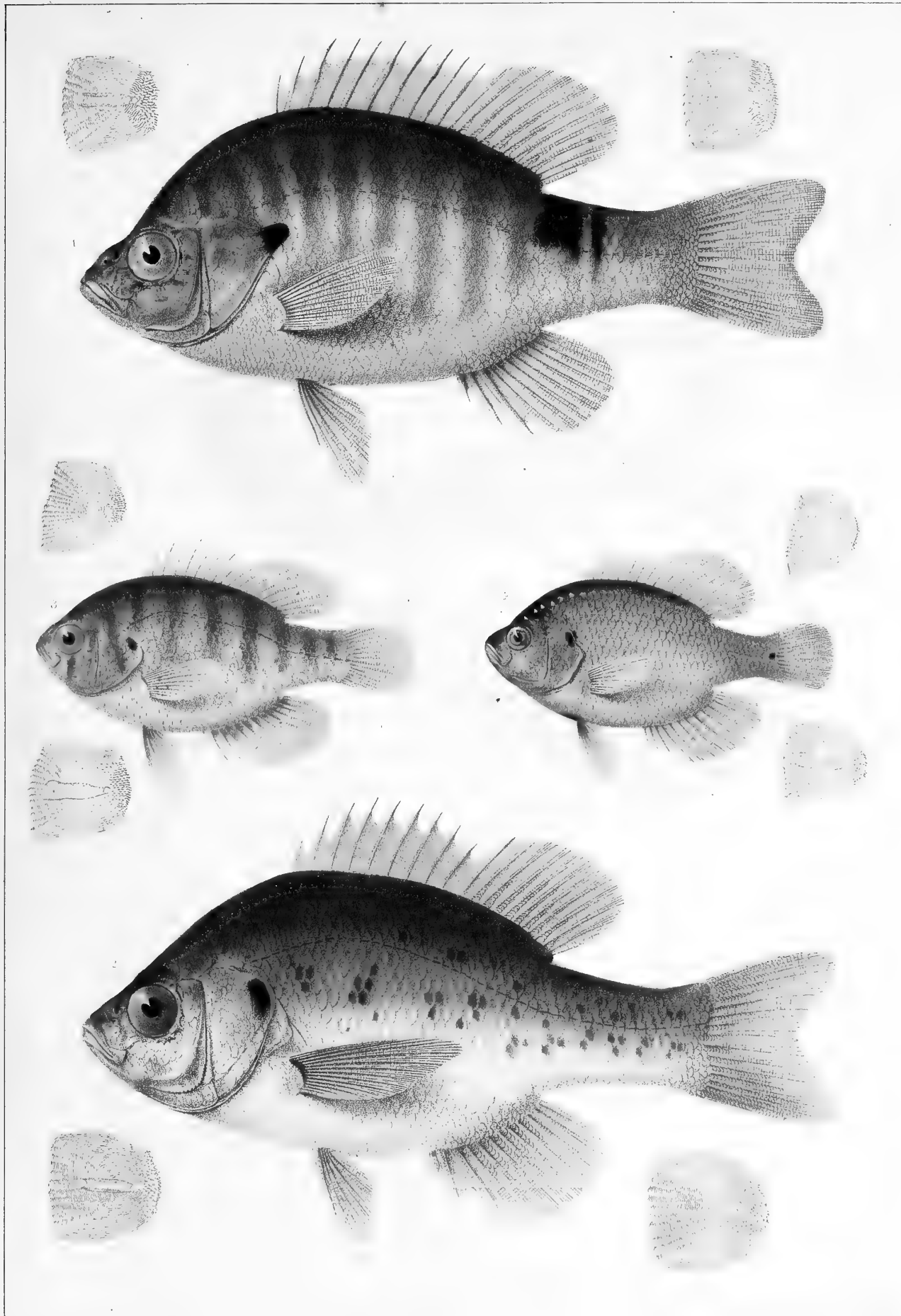








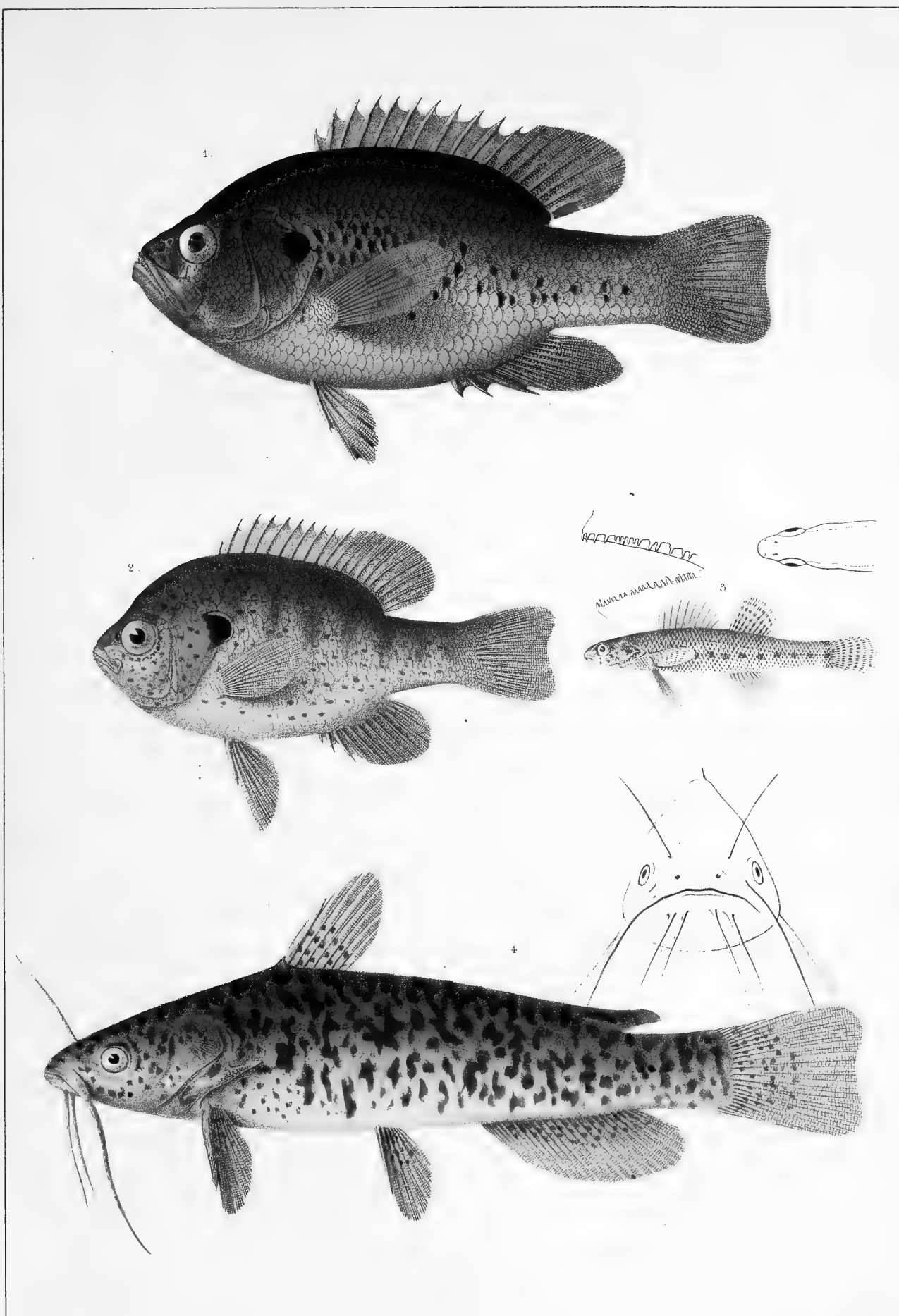




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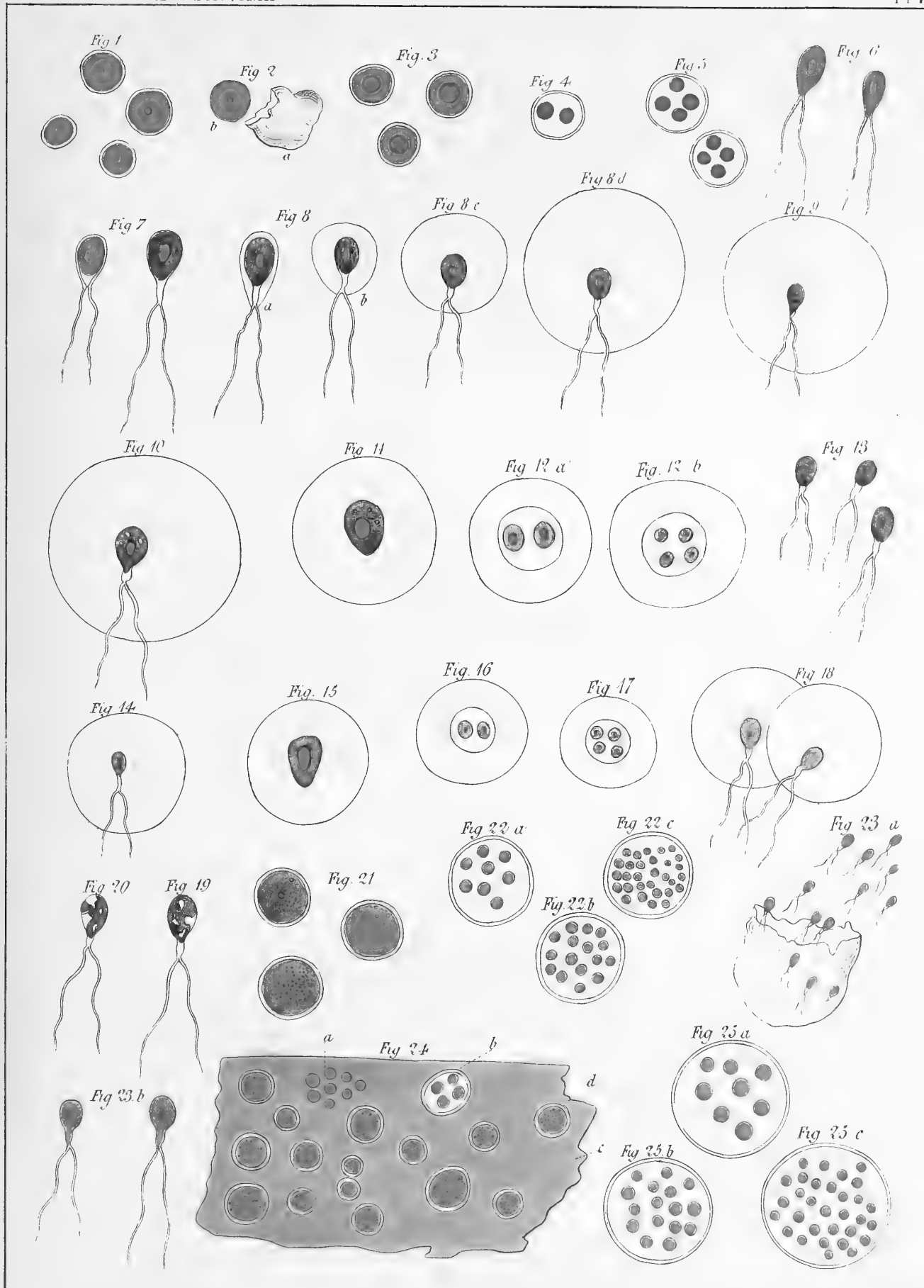
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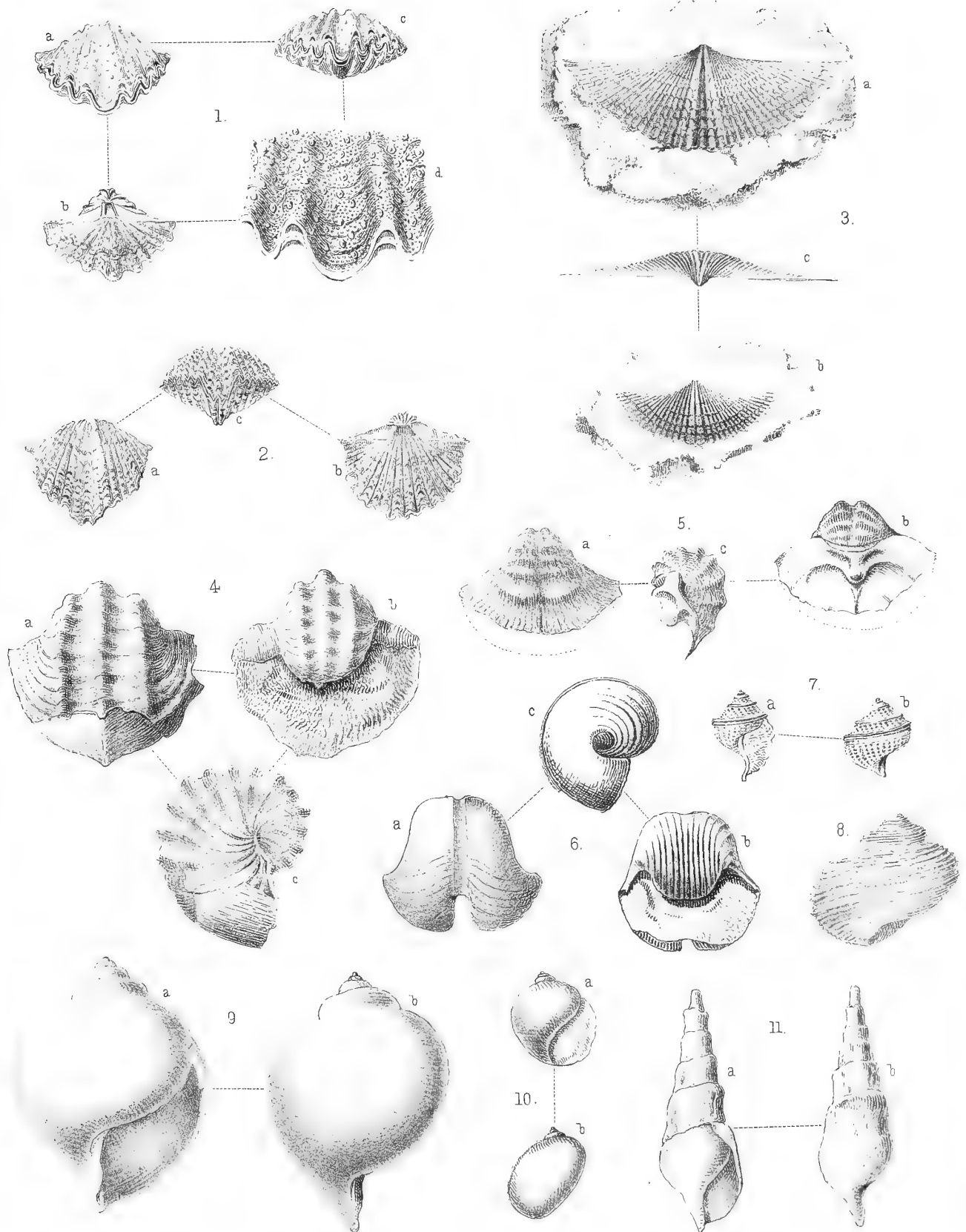


*Spermestes nigriceps*, Cassin

1 Male 2 Female

3 *Spermestes fuscans* Cassin

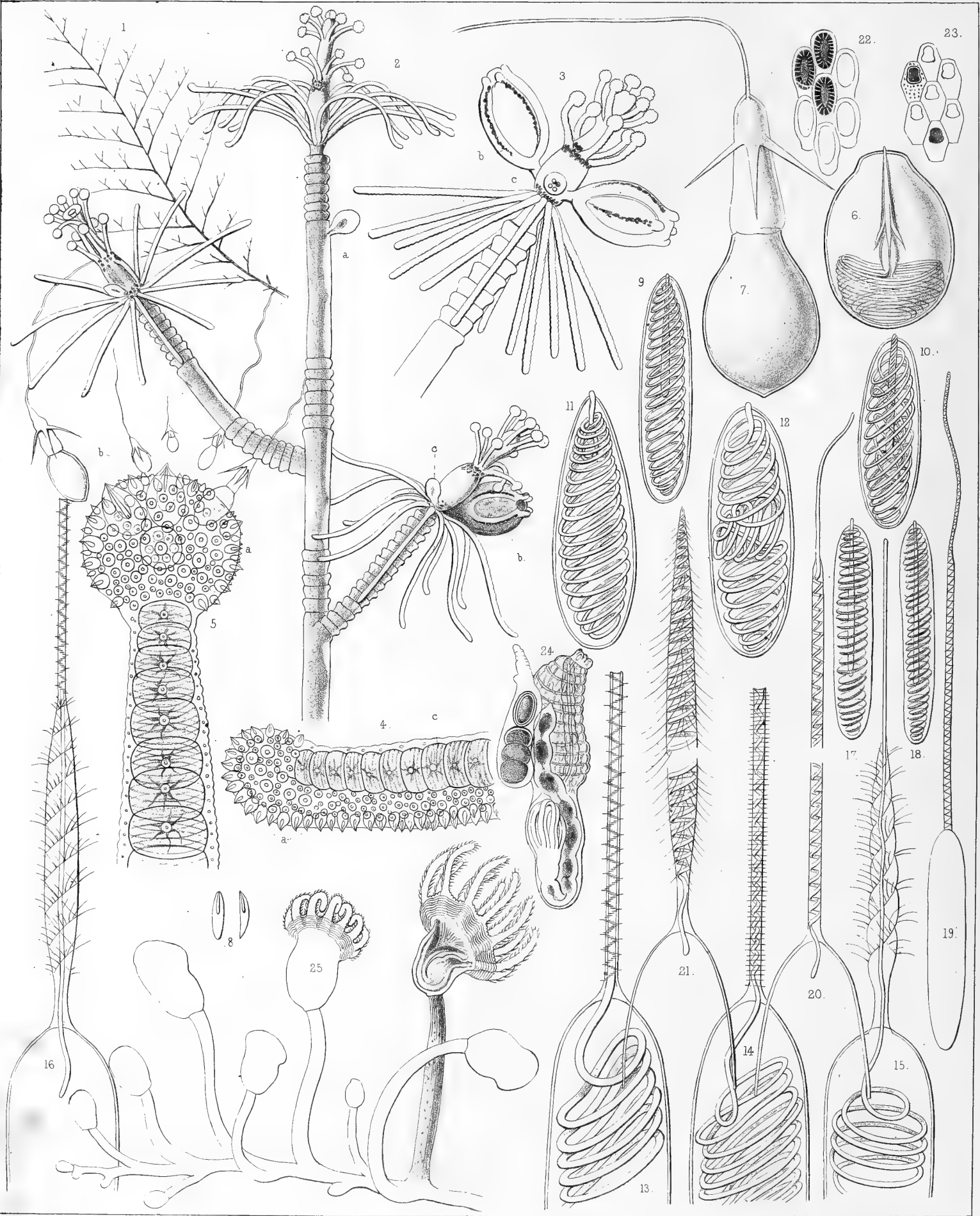


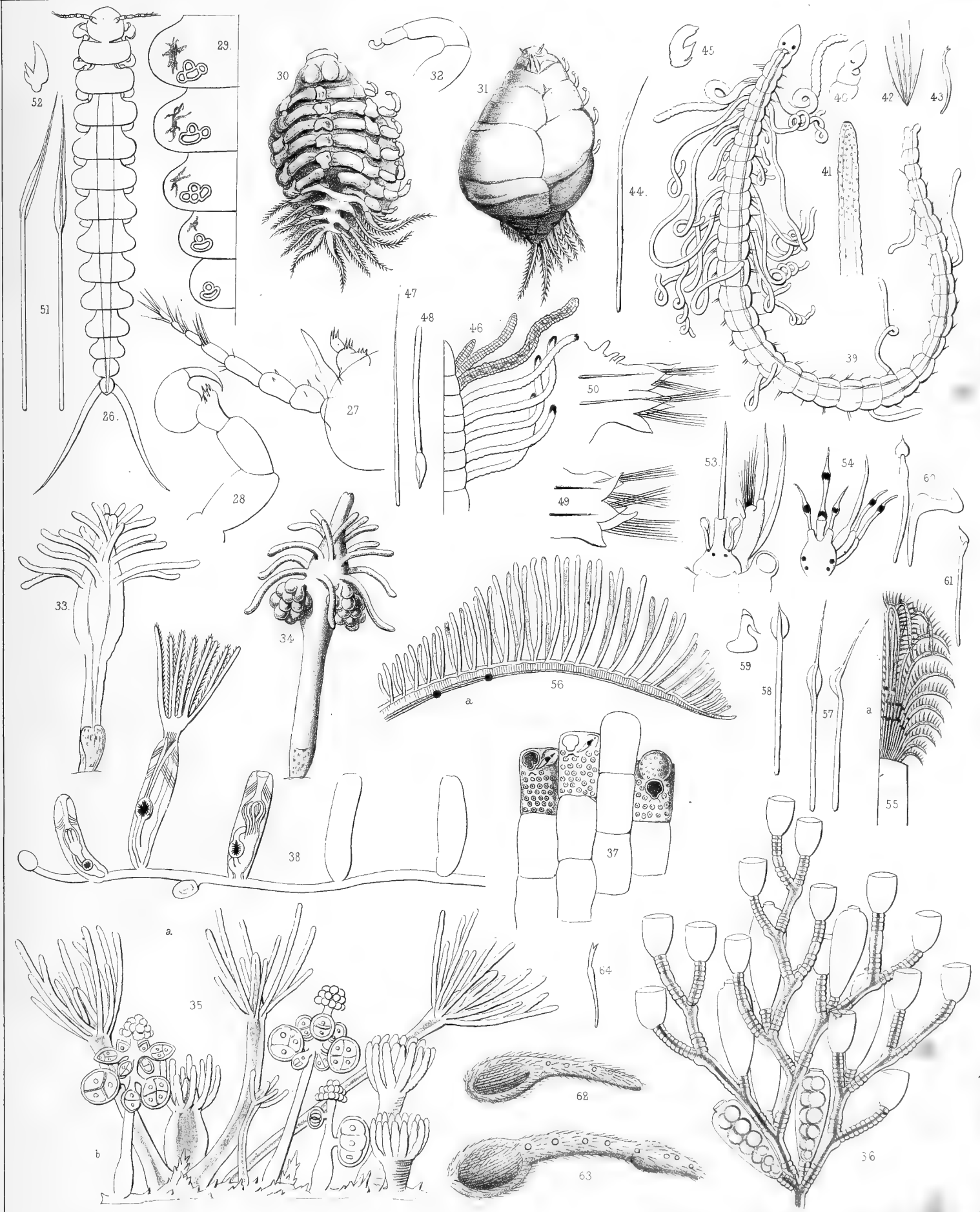
















*Ara auricollis*. Cassin





*Chrysotis viridigenalis*. *Cassin*







1. *Pittacula lineola*. Cassin.  
2. *Protoparce aurifrons*. Cassin.



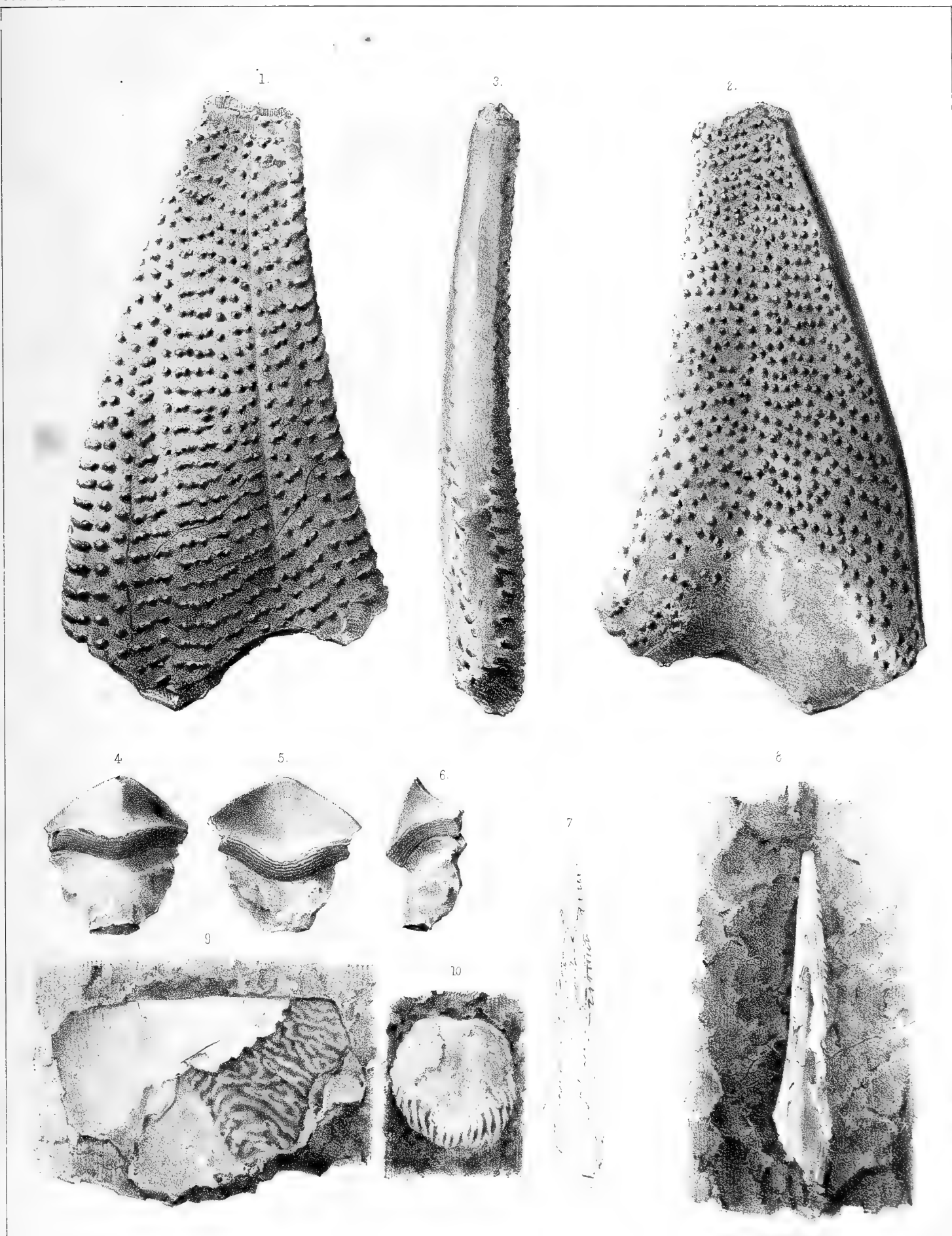




A. S. P. Del

T. Sinclair's Coll. Phil<sup>a</sup>

EDESTUS VORAX, Leidy



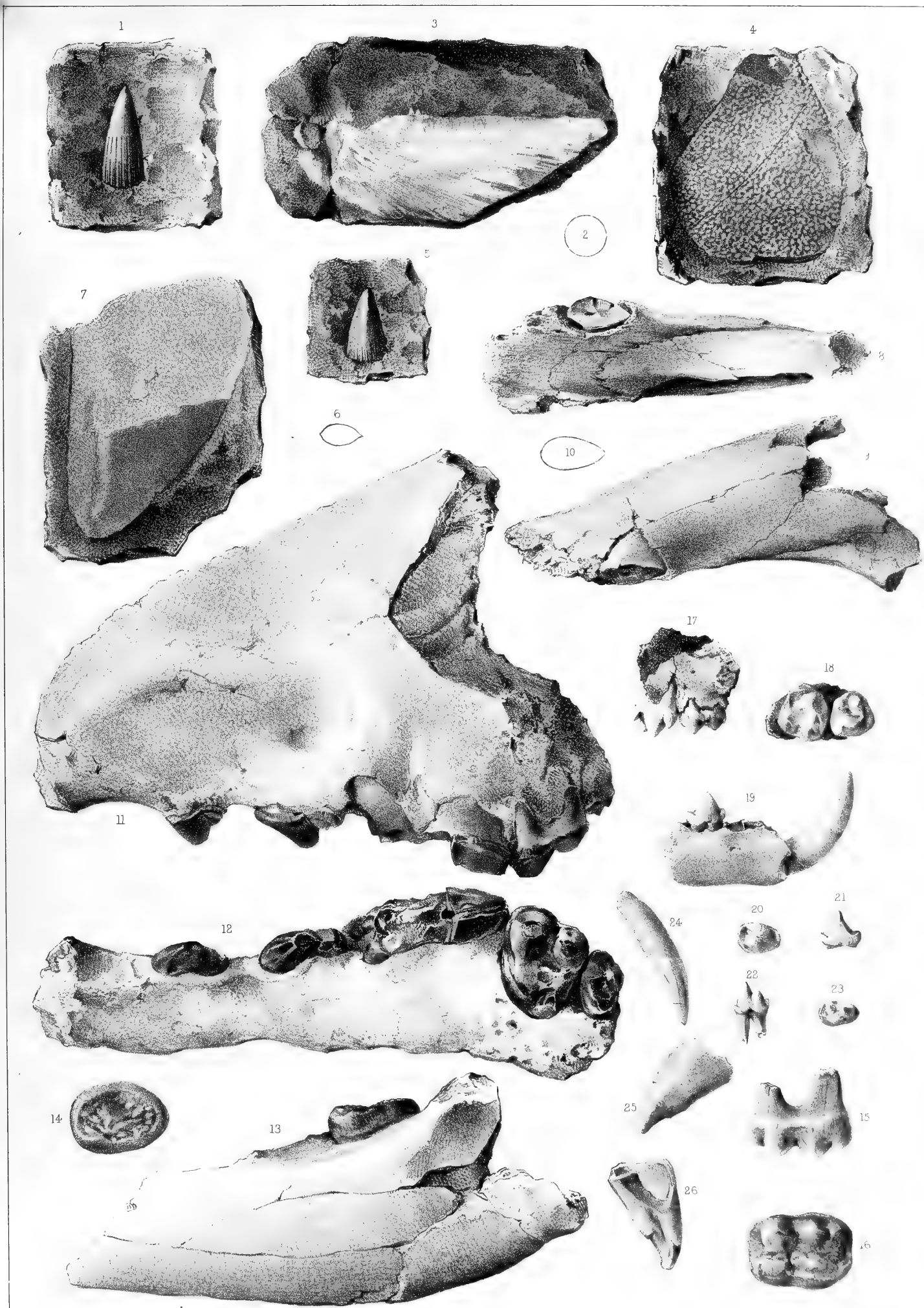
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1-3 ORACANTHUS 4-6 PETALODUS. 7-8 STENACANTHUS.  
9-10 HOLOPTYCHIUS





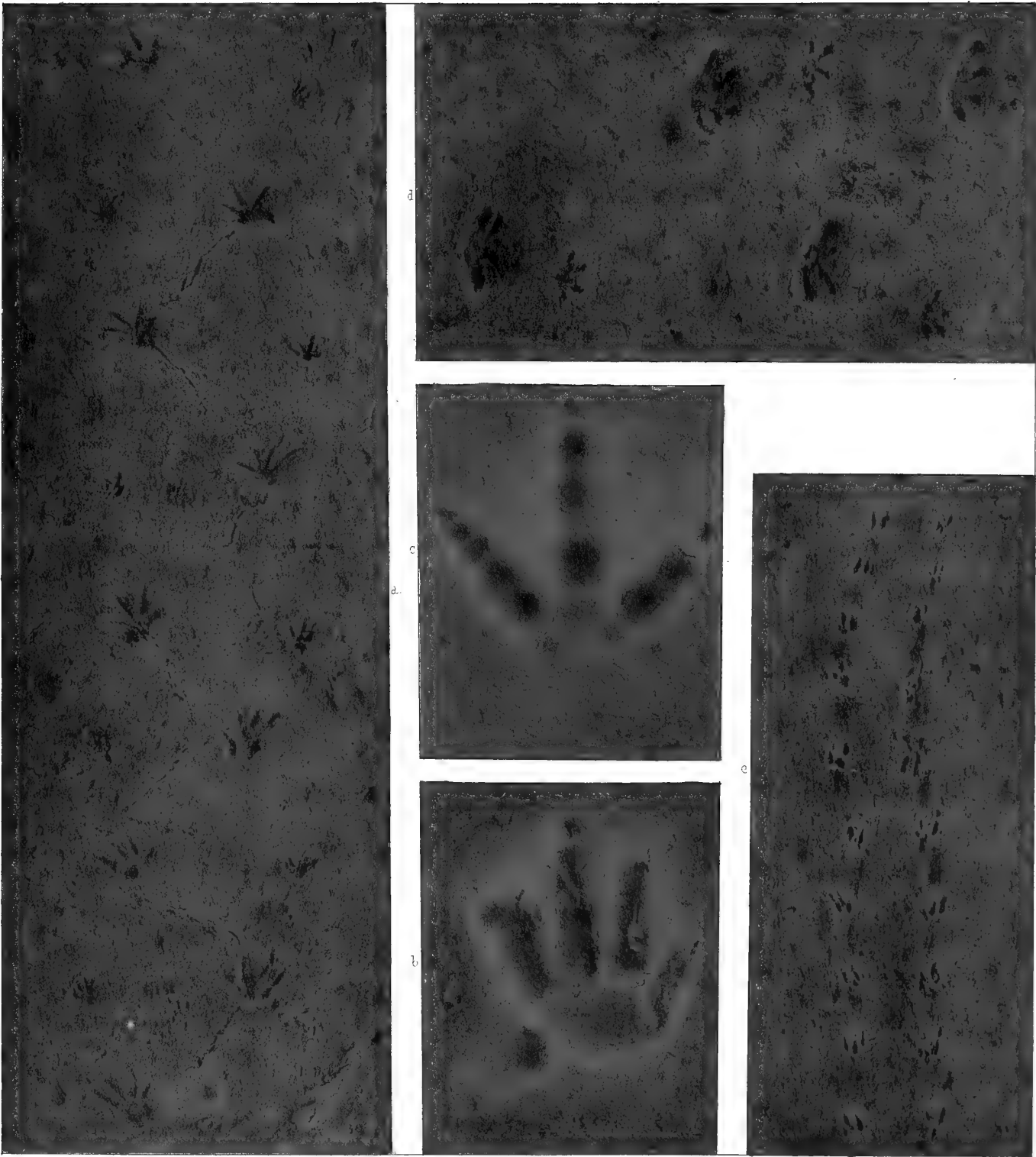


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T. Sinclair's Lith. Phil<sup>a</sup>

1\_4 HOLOPTYCHIUS. 5\_7 APEDODUS. 8\_10 CAMELOPS. 11, 12 CANIS.  
13\_16 URSUS. 17\_24 PROCYON. 25, 26 ANOMODON.



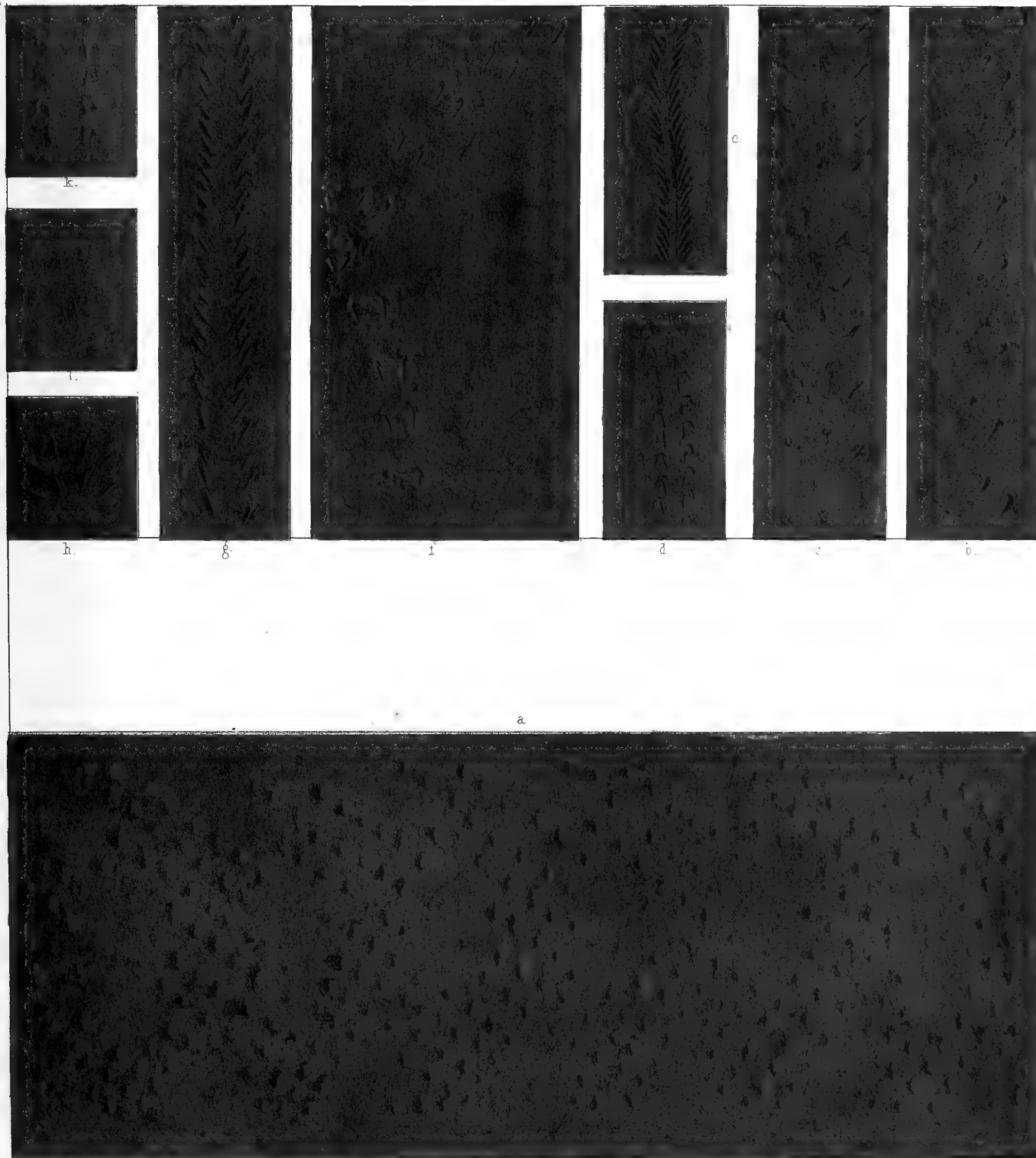


On Stone by J. Deane, M.D.

J. Sullivan & Lth. Phila.

SANDSTONE FOSSILS  
CONN. RIVER.





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Source: "Nat. Hist."

SANDSTONE FOSSILS  
CONN. RIVER.









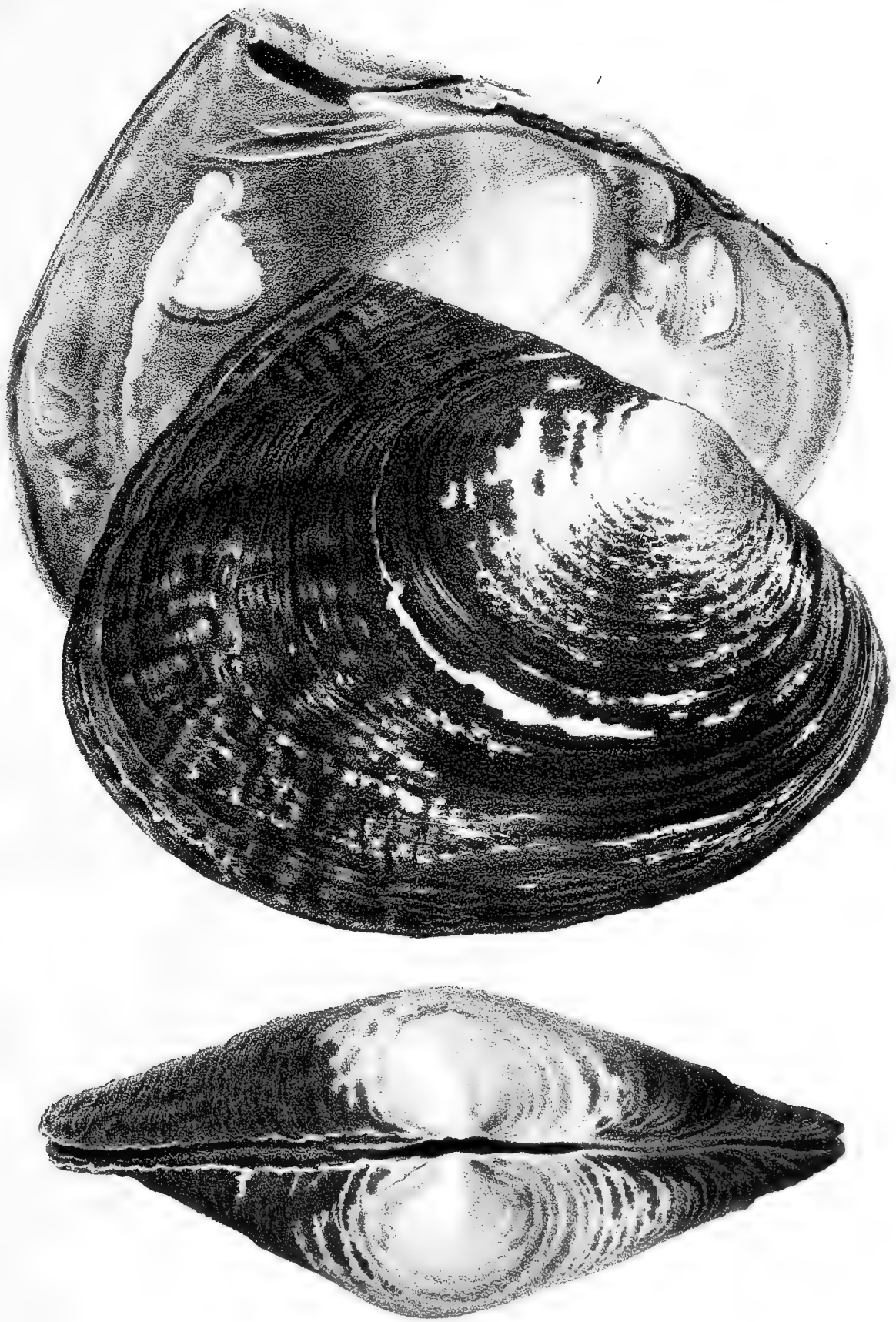


DIAGRAM A.

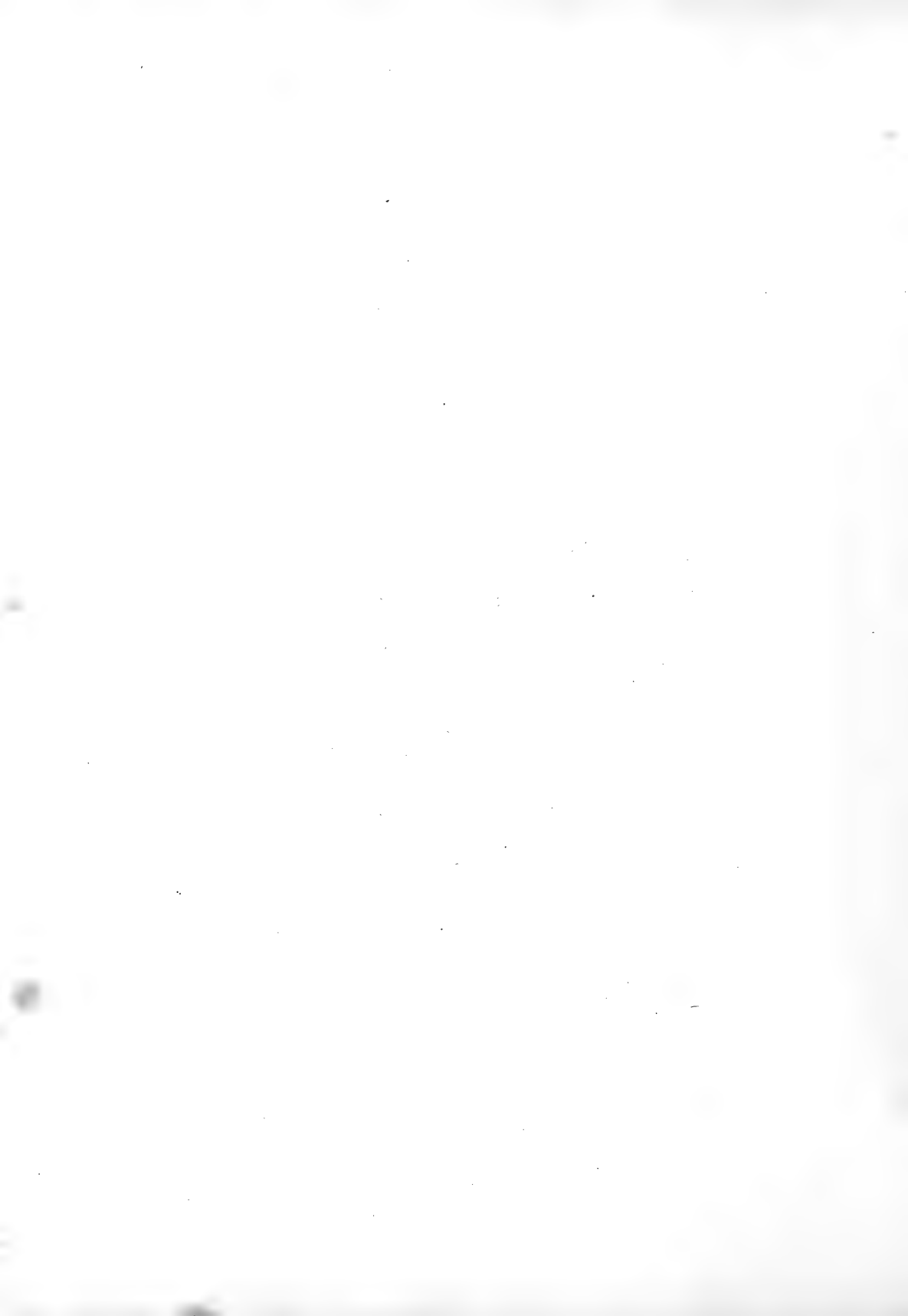
DIAGRAM B.

DIAGRAM C.





1. *Unio Hainesianus*





*Unio Mycetianus*

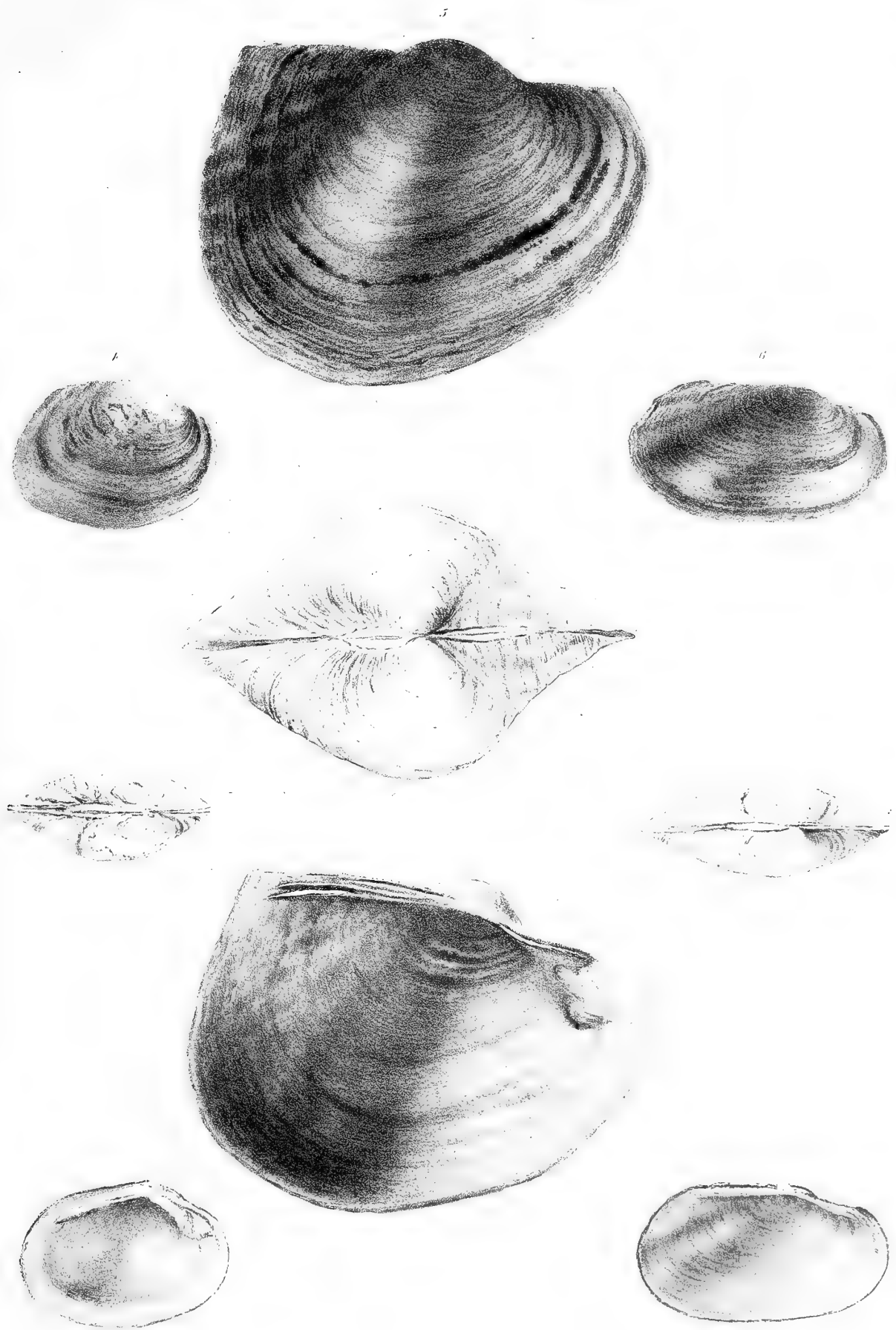




3 *Unio Housei*

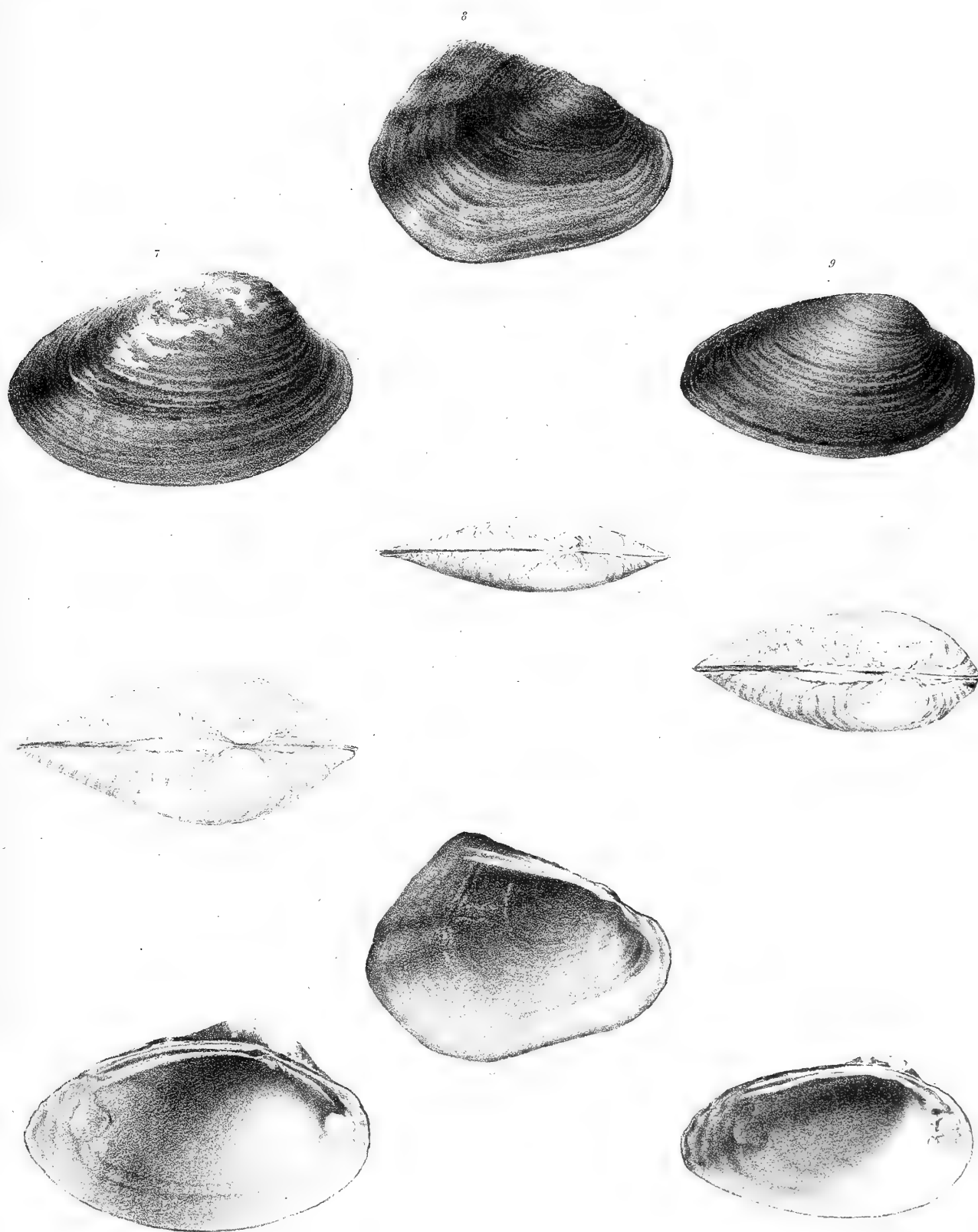






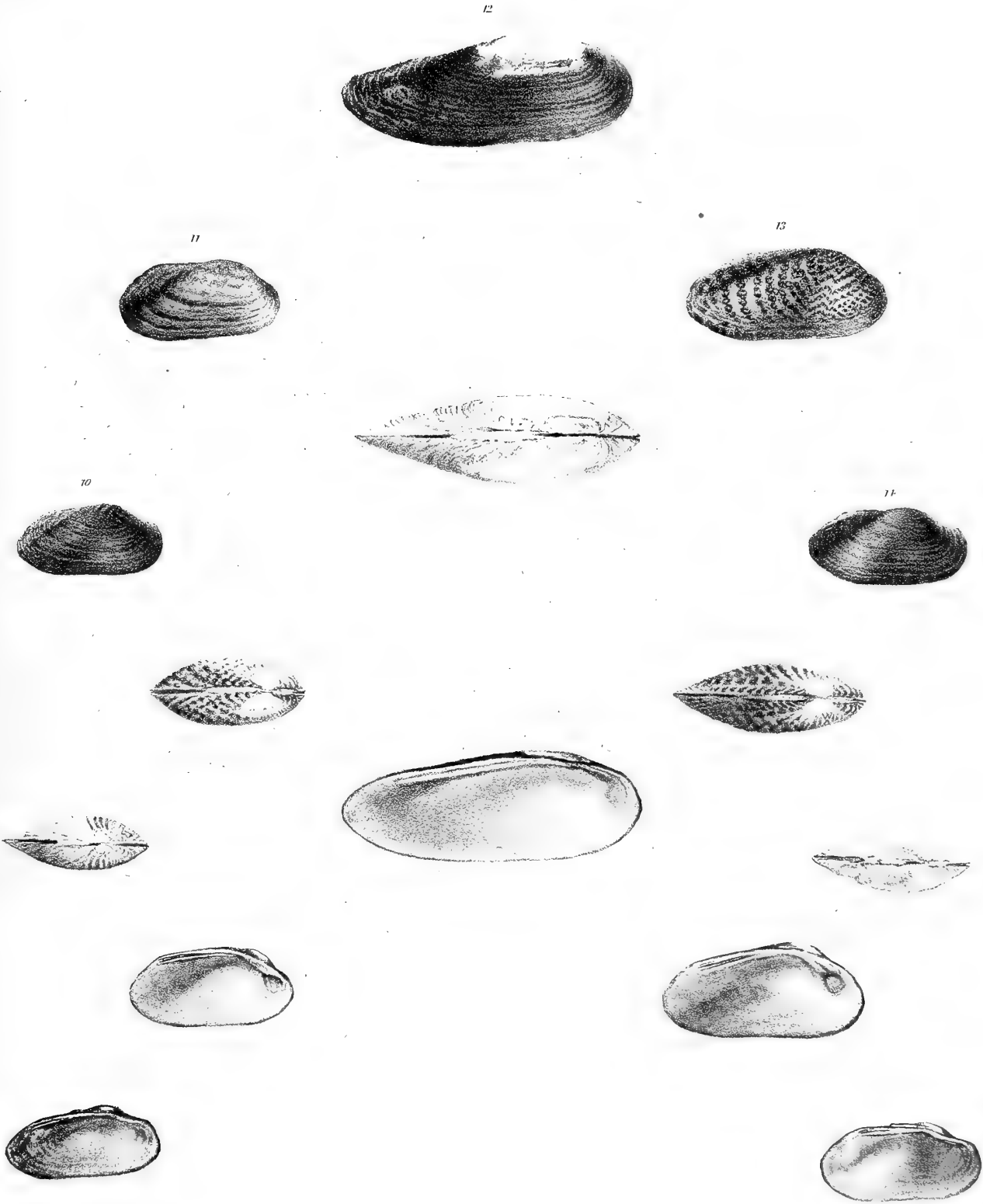
1 *Unio latens*  
5 *Unio gravidus*  
6 *Unio mornatus*





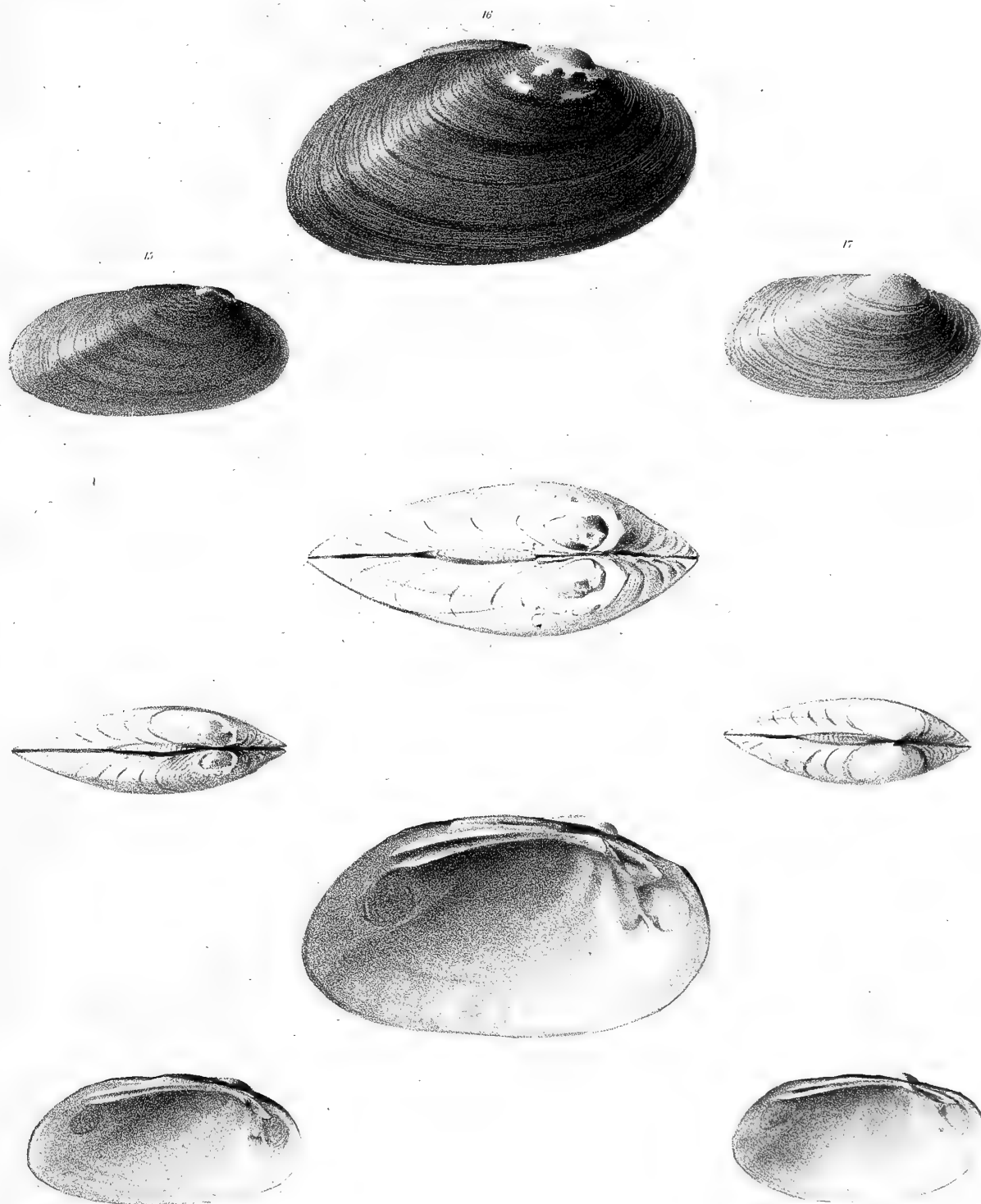
7 *Unio rusticus*  
8 *Unio eximius*  
9 *Unio tumidulus*





10 *Unio humilis*  
11 *Unio phaeus*  
12 *Unio sagittarius*  
13 *Unio scobinatus*  
14 *Unio substratus*

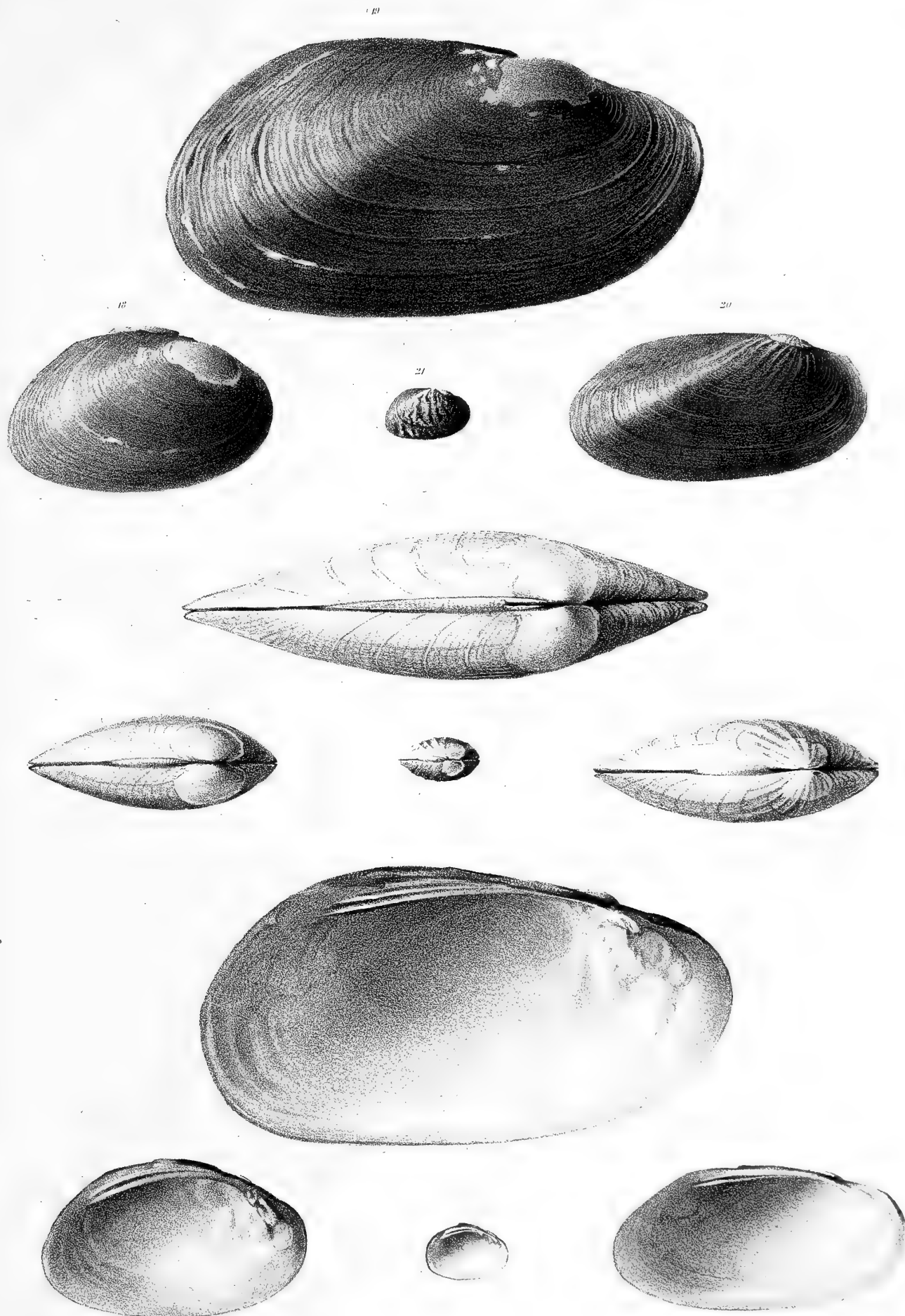




15. *Unio Africanus*  
16. *Unio Verreauxianus*  
17. *Unio Shurtleffianus*

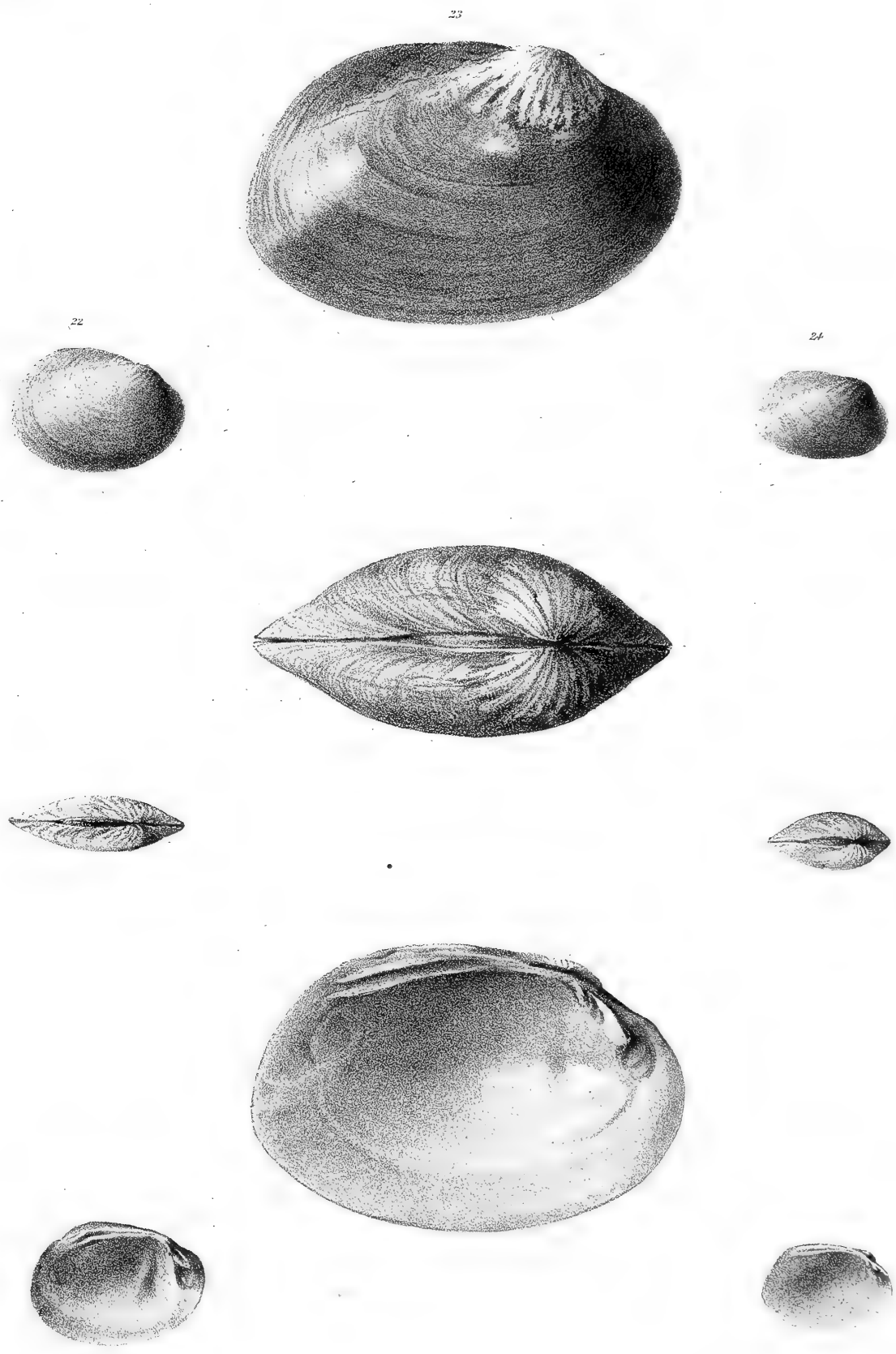






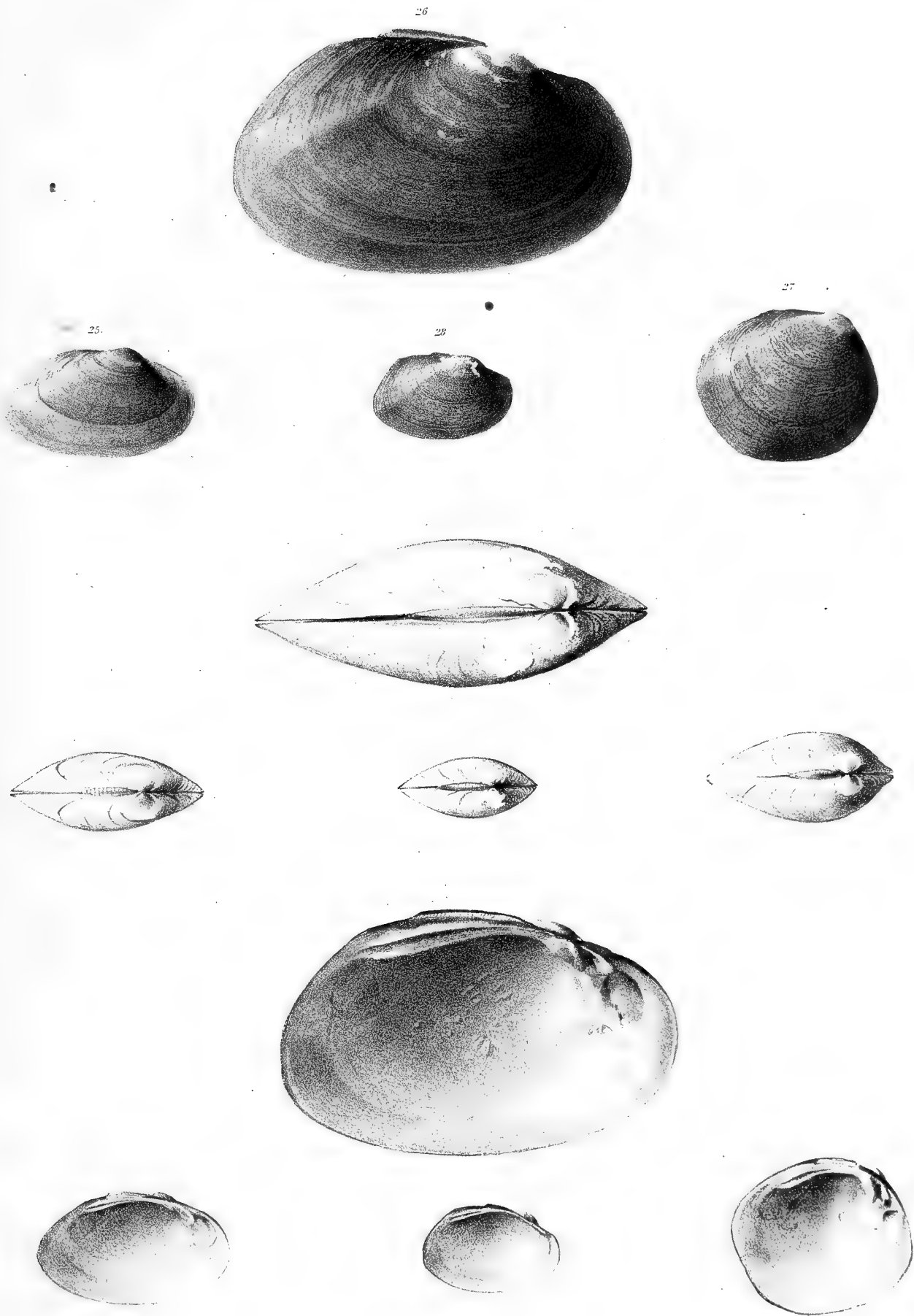
- 18 *Unio effulgens*
- 19 *Unio Shuttleworthii*
- 20 *Unio Dunkerianus*
- 21 *Unio nucleus*





22 *Unio Brownii*  
23 *Unio Wheatleyanus*  
24 *Unio suavidicus*

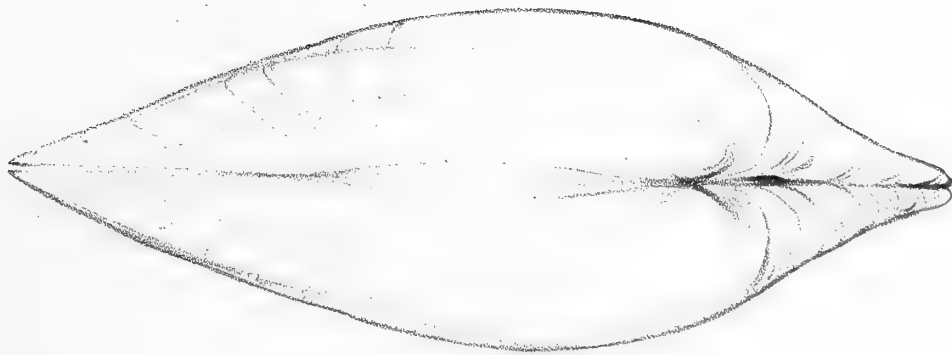
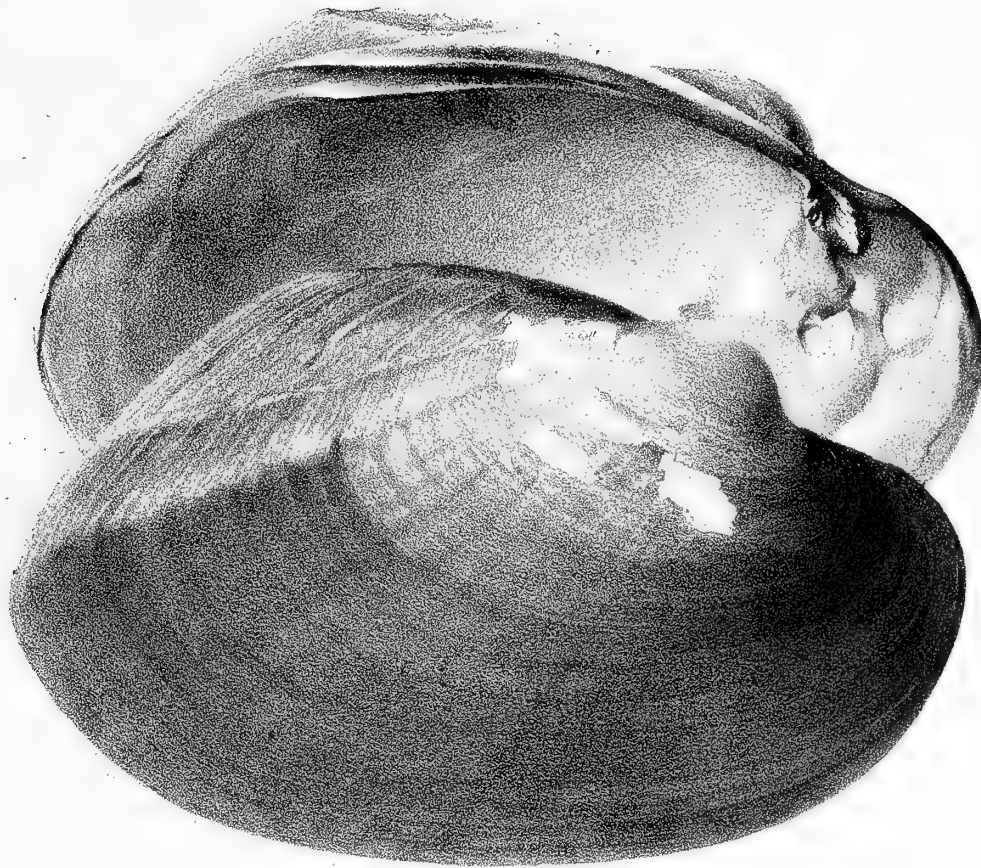




25. *Unio Nuttallianus*  
26. *Unio umbrosus*.  
27. *Unio Newcombianus*.  
28. *Unio Cambodiensis*.



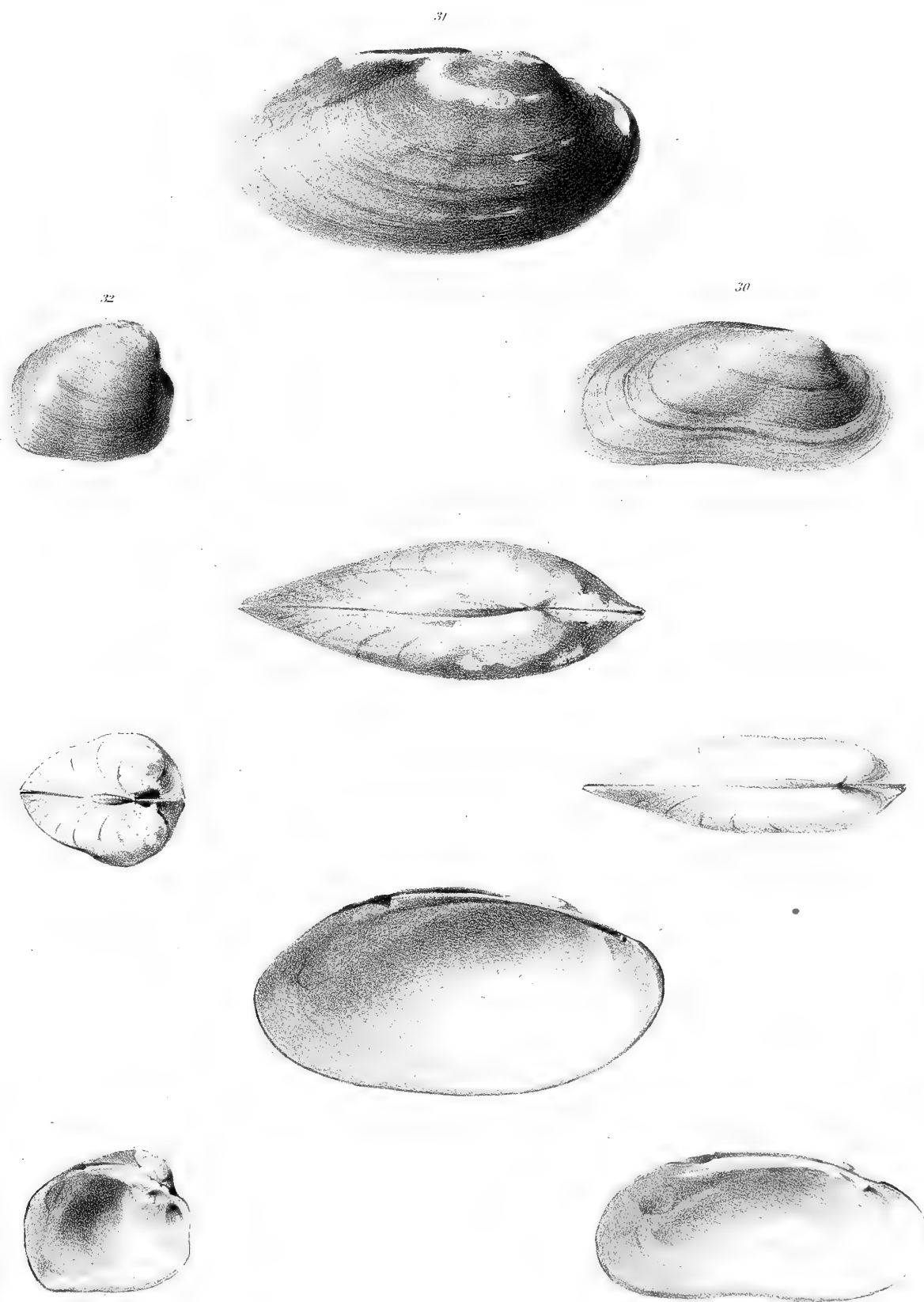
29.



29. *Unio Coloradoensis*.

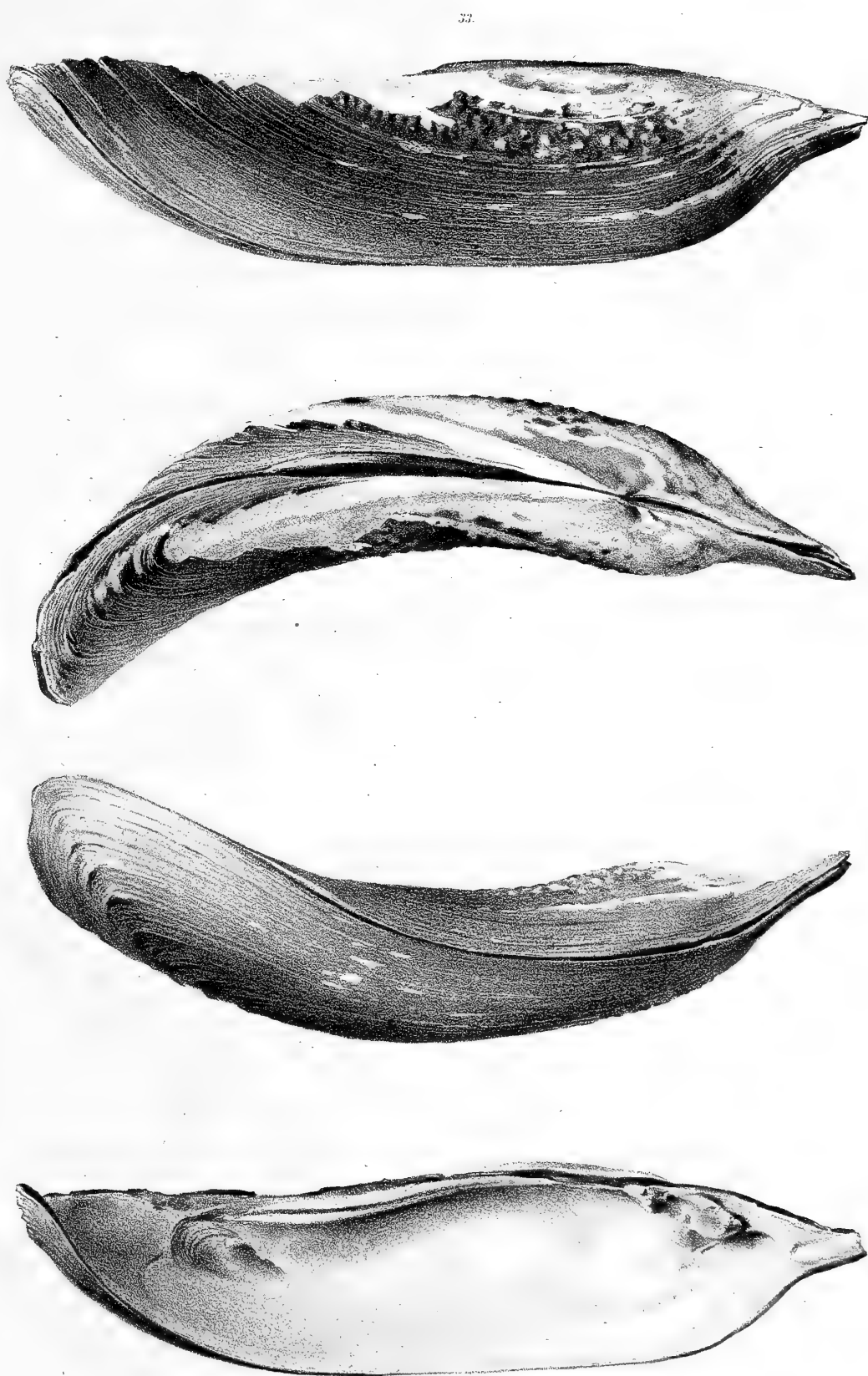






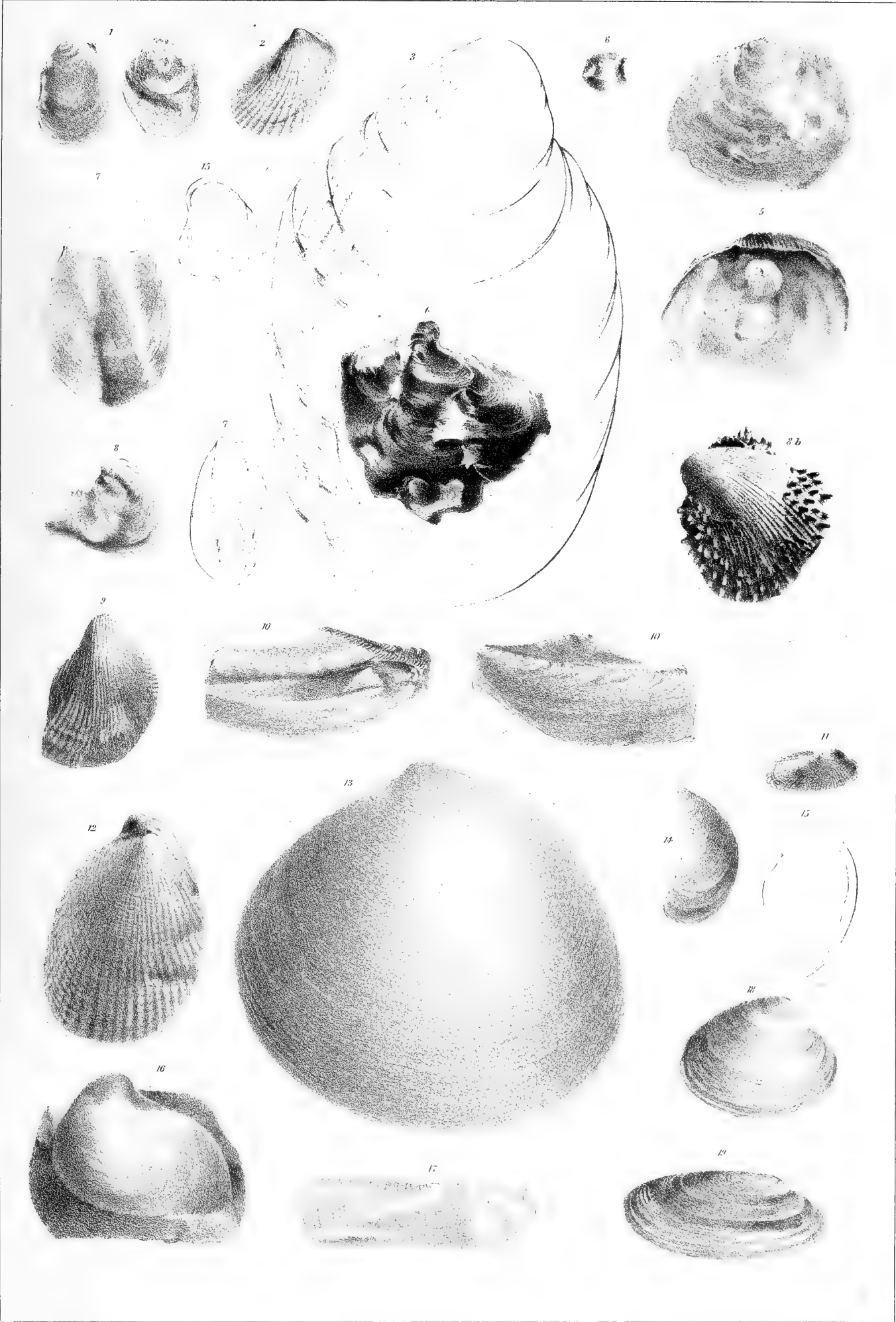
30. *Unio poeyanus*.  
31. *An. holtonis*.  
32. *Plagiodon isocardioides*.



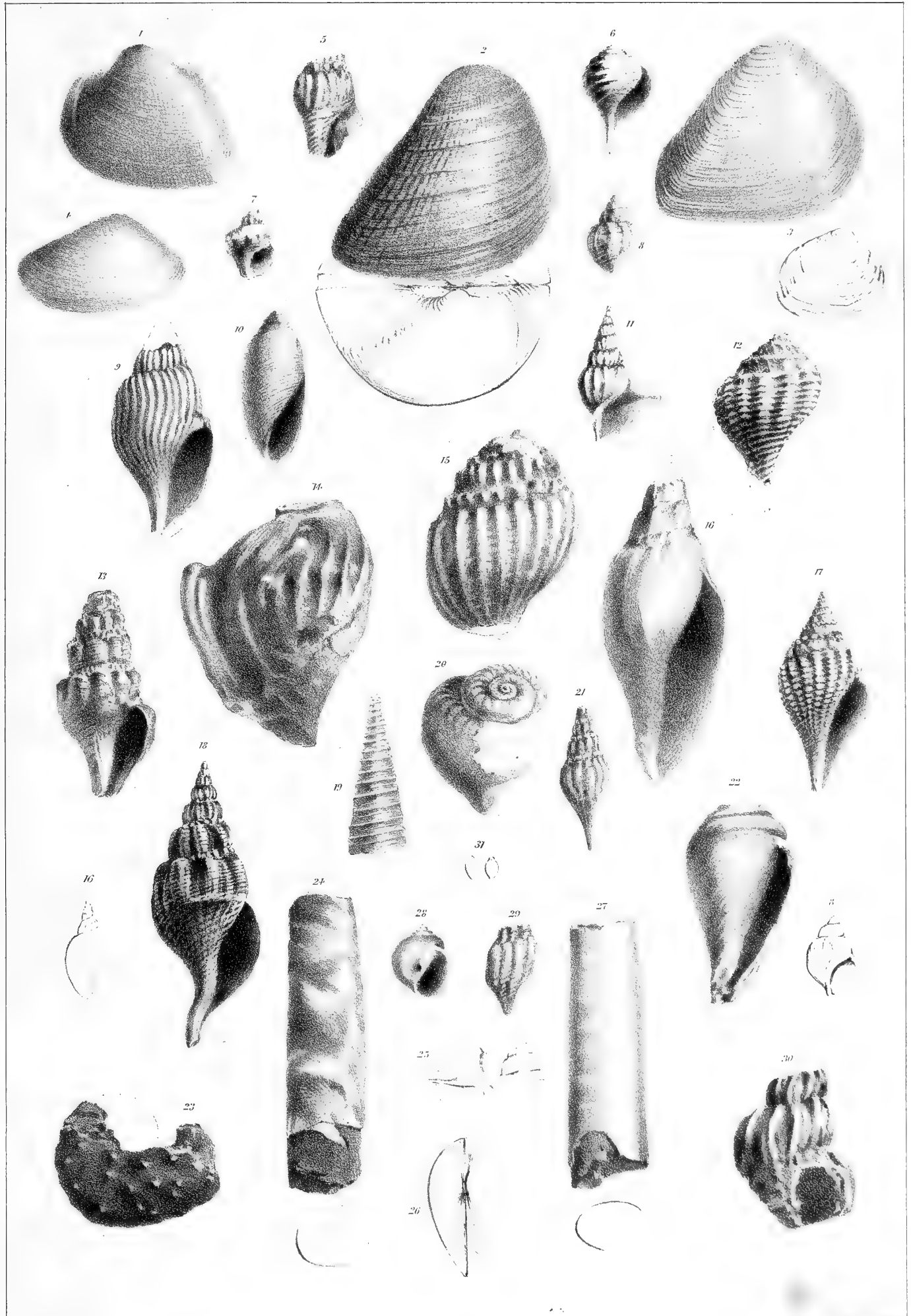


33. *Triquetra contorta*.



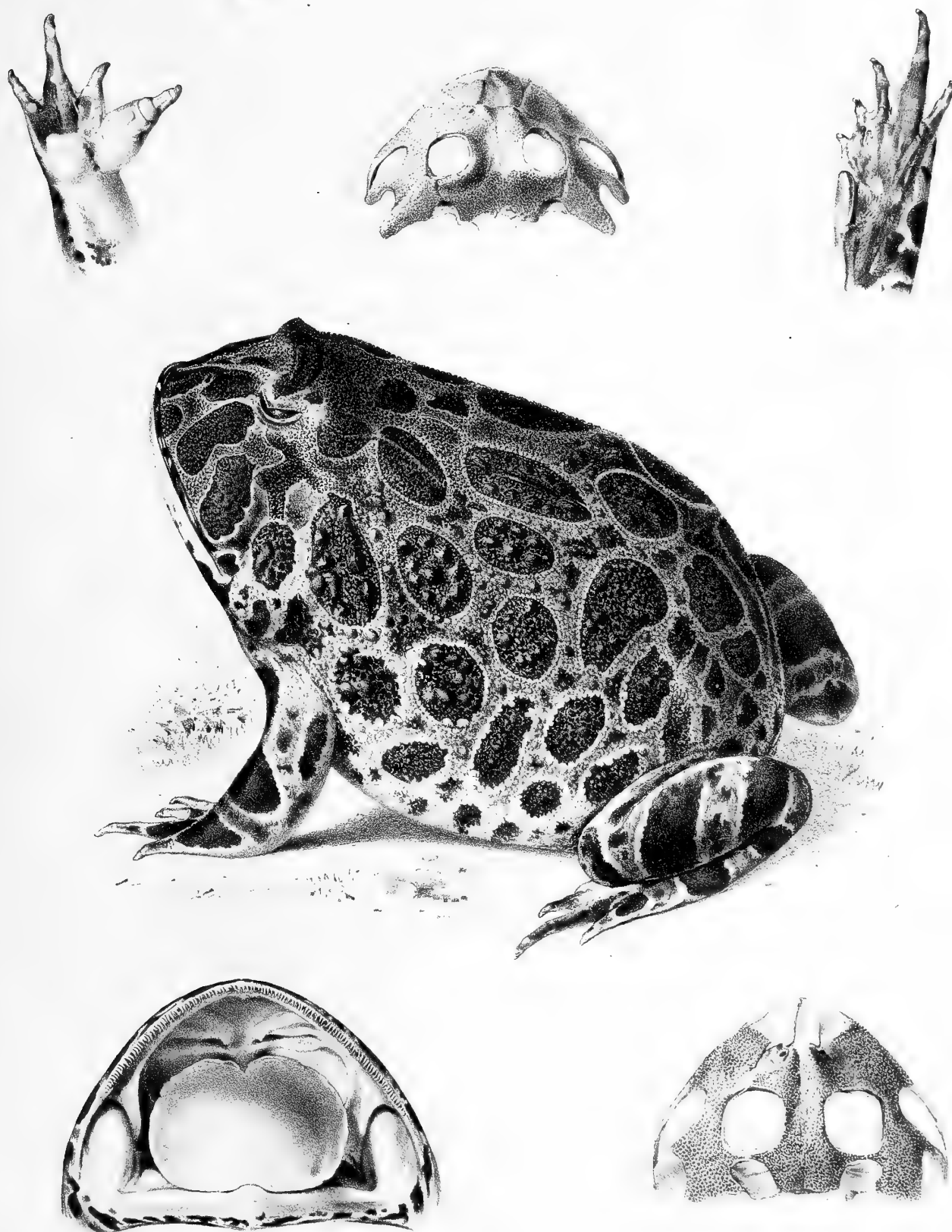












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